

KALTENBORN



Manual Mobilization of the Joints

Joint Examination and Basic Treatment



Volume III

Traction-Manipulation **of the Extremities and Spine**

Basic thrust techniques

by **Freddy M. Kaltenborn**
in collaboration with
Traudi Baldauf Kaltenborn
and Eileen Vollowitz

First Edition, 2008
Norli
Oslo, Norway

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2008

Published and distributed by

Norli: Oslo, Norway

Also distributed by

OPTP: Minneapolis, Minnesota, USA

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Bahnhofstrasse 45, D-88175 Scheidegg, Germany
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Published 2008 and distributed by:
Norli
Universitetsgaten 24
N-0162 Oslo, Norway

Also distributed by:
OPTP
PO Box 47009
Minneapolis, MN 55447
USA
(763) 553-0452; (800) 367-7393
(763) 553-9355 fax

This book is a companion volume to:
Manual Mobilization of the Joints, Volume I
The Extremities
2007 (ISBN 978-82-7054-043-3)
Manual Mobilization of the Joints, Volume II
The Spine
2005 (ISBN 978-82-7054-069-2)

Manual Mobilization of the Joints
Volume III: Traction-Manipulation of the Extremities and Spine
ISBN 978-82-7054-073-0

■ Acknowledgements

It took me over seven years to complete this book, far longer than the preparation for my other textbooks. I wanted to be absolutely certain that the manipulative techniques presented would be safe in inexperienced hands, that the underlying principles of safe manipulative practice were clearly expressed, and that each manipulation technique was illustrated and described with clarity.

I am grateful for the encouragement and contributions of many of my colleagues throughout the effort. I am especially indebted to my wife Traudi Baldauf Kaltenborn and my editor Eileen Vollowitz, who with friendship, intelligence, and candor nourished my mind and focussed my vision on the journey to put my discoveries and thoughts to paper.

Freddy Kaltenborn, 2008

■ Why I wrote this book

I wrote this book to present a safe and effective alternative to high-risk rotatory thrust manipulations, suitable for training students of manipulation. I have refined and developed these techniques over decades of practice and believe them to be the best way to introduce manipulation techniques to novices.

In recent years I have been alarmed to see manipulation techniques presented on short weekend courses and published in texts for novice practitioners, that include advanced techniques that can cause harm in less-skilled hands and some techniques that are unnecessarily dangerous even in skilled hands. Advanced manipulative techniques should only be taught with hands-on training in clinical settings. Short courses and textbooks alone cannot provide the supervision and time necessary to develop competence in manipulation. The speed, timing, coordination and feel for joint manipulation takes many years of daily practice. Until and unless a practitioner acquires these skills, they should limit their practice to manipulations that are safe in less skilled hands, such as those presented in this book.

Manipulation is *the* most valuable technique for the treatment of intraarticular restrictions. Those who say vibrations or slow-stretch mobilizations alone are equally effective are mistaken, and likely do not possess sufficient manipulative skill upon which to test their assumptions on real patients.

The manipulation techniques presented here are applicable to any student of joint manipulation, however I wrote this book primarily for entry-level physical therapists. Joint manipulation is part of a rich tradition in the manual therapies and has been an important part of physical therapy practice since the early 1800's.

It is critically important that joint manipulation be taught in all physical therapy schools. Some physical therapy schools omit manipulative training from their curricula, and this fact is taken by some courts of law as justification to prevent physical therapists from delivering manipulative treatment. Over the past century, there have been repeated attempts from both within and outside the physical therapy profession, to limit the practice of joint manipulation. I have battled against these efforts for decades, and continue to support and promote the skilled delivery of manipulative treatment by physical therapists.

I have not used a rotatory technique in my practice nor taught a rotatory manipulation in over 15 years. It is my hope that all practitioners of manual therapy will follow my example and avoid these high-risk treatments.

Freddy Kaltenborn, 2008



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PRINCIPLES

Terminology for traction-manipulation

Terminology in use by various schools of thought in manual therapy are not yet standardized. In order to master Kaltenborn techniques, the practitioner must have a clear understanding of the unique terminology used within the Kaltenborn method. See *Volume I: The Extremities* for a more detailed explanation of Kaltenborn manual therapy terminology.

Treatment Plane

The Treatment Plane passes through the joint at a right angle to a line that connects the axis of rotation in the convex joint surface to the deepest aspect of the articulating concave joint surface. For practical purposes, one can estimate the location of the Treatment Plane by imagining that it lies over the concave articular surface.

Translation

Translation is a straight-line bone movement *along* an axis without rotation. Translations are performed passively as traction, compression, or gliding movements in relation to the Treatment Plane. The corresponding movement in the joint is called "joint play".

Rotation

Rotation occurs when the path of a bone movement curves *around* an axis. The corresponding movement in the joint is called "roll-gliding". All active movements are technically rotations, however most practitioners use the term "rotation" only to refer to movements that curve around the longitudinal axis of a bone.

Roll-Gliding

In the human body, no adjacent joint surfaces are completely congruent (whether flat or curved), so all joint movement occurs as a combination of rolling and gliding. Normal movement characteristically begins with a short curved glide parallel to the joint surface, followed by a rolling movement.

Traction-Manipulation ("Thrust" or "Quick Mobilization")

Manipulation is a high velocity, low amplitude thrust movement, most commonly used to normalize joint movement when treating intraarticular restrictions. Traction-Manipulation is a *translatory* high velocity, low amplitude thrust movement producing separation (distraction) in the joint at a right angle to the Treatment Plane. All points on the adjacent joint surfaces move equally apart from one another resulting in separation of the joint surfaces. There is no curvature in the movement.

1 Introduction

It is a paradox that the manipulative techniques that are safest for the patient and use the least force, are often the most difficult to master because they require greater palpation sensitivity, coordination and quickness. Conversely, the manipulative techniques that are easiest to learn are often the most dangerous for the patient because they incorporate longer lever arms, non-specific gross rotatory movements, and forceful large-amplitude movements.

While gross manipulations can be effective, they can also cause serious injuries and kill as evidenced by documented accidents resulting from manipulative treatment. These techniques can injure both extraarticular and intraarticular structures and have no place in entry-level education. One could argue that some of these techniques should be banned altogether, especially in the upper cervical spine due to the vulnerability of the vertebral artery, and in the lumbar spine because of the possibility of disc rupture.

There are three basic manipulations used to treat intraarticular restrictions: two are straight-lined (i.e., translatory traction and translatory gliding) and one is curved (i.e., rotatory). This book presents selected translatory traction-manipulations only.

Gliding manipulations carry some risk of injury if applied in an unskilled manner, for example, without quickness, with large amplitude or without a traction component. Gliding manipulation are best taught only to those who have acquired the prerequisite quickness and coordination learned through the practice of safe traction-manipulations.

Rotation manipulations carry significant risk of injury and are not used in the Kaltenborn system.

We practice manipulation as a high velocity, low amplitude, low force, straight-line impulse (“thrust” or “quick mobilization”) applied to a joint showing a suitable end-feel. The manipulation is initiated from the Actual Resting Position, gently tightening the slack with a translatory movement and applying a thrust the instant the First Stop is met. The mechanical goal is to produce joint separation and restore the translatory gliding component of normal joint roll-gliding. The treatment goal is to restore normal, painless joint function. The desired effect is to move the restricted First Stop to the normal First Stop.

Joint manipulation is the most effective treatment available for intraarticular restrictions. Traction-manipulation can also be used as a trial treatment, and can also be an effective means to release a hypermobile joint locked in a positional fault.

■ The “pop”

The audible “pop” (“click” or “crack”) associated with joint manipulation, is thought to be the end result of a mechanism known as cavitation. Radiographs reveal gas bubbles in the synovial fluid as the manipulation produces a vacuum (decreased pressure) within the joint. Within 0.01 seconds, these small gas bubbles combine into a larger bubble and synovial fluid rushes into the area of low pressure, causing the bubble to collapse. The collapse of the bubble is thought to produce the audible sound.

The after-effects of cavitation are thought to be therapeutic. There is an increase in the joint space for approximately 15 minutes (Unsworth et al, 1971), increased range of movement (Surkitt et al, 2000) and neurological reflex muscle inhibition (Brodeur, 1995). These immediate effects of manipulation enhance joint function. After a successful joint manipulation, the “pop” cannot be reproduced again for 15 - 20 minutes or more.

Neither patients nor practitioners should place too much emphasis on the audible “pop”. Effective joint manipulations do not always produce an audible sound. Many joint fixations loosen without an audible sound. In many cases, the sound simply serves to make the therapist happy.

The audible “pop” primarily occurs with manipulation of synovial joints. Manipulation of synchondroses (e.g., a lumbar disc joint) rarely produces a sound.

Practitioners who focus solely on creating an audible joint “pop”, often resort to excessive force and nonspecific techniques using long levers, large amplitudes, and rotational movements. Repeated manipulations of this kind generally “pop” the normal joints and have little or no effect on restricted joints. Frequent, repeated manipulation of any joint can eventually lead to chronic irritation, pain, inflammation, hypermobility or symptomatic instability. Repeated rotational manipulations with long lever arms, accelerate these damaging effects.

Not all joint sounds reflect the same underlying physiology. Joint sounds can emanate from both normal and pathological joints with a variety of movements. The “crack” associated with a manipulative release of a fixated joint, is unlikely the same as the “pop” one hears when one cracks ones own joints. Self-manipulation, that is, cracking ones own joints, rarely affects joint range of motion or pain.

■ Evaluation for manipulation

The Orthopedic Manipulative Therapy (OMT) evaluation process used to determine the applicability of traction-manipulation for a particular patient condition, is the same as that used for a Grade III traction-mobilization.

There are four goals of evaluation:

- **Physical diagnosis.** To establish a physical, or biomechanical, diagnosis.
- **Contraindications.** To identify contraindications to treatment.
- **Indications.** To identify indications to treatment.
- **Measuring progress.** To establish a baseline for measuring progress.

Translatory joint play including end-feel, is assessed in all directions prior to manipulation. This is done to confirm the diagnosis, to screen for contraindications, to determine whether a joint is suitable for manipulation, and to establish a baseline for measuring progress. Joint play is easiest to palpate in a joint's *Actual Resting Position*, where the joint capsule, ligaments, and muscles are most lax.

Physical diagnosis

Musculoskeletal¹ conditions that respond well to manipulation typically present with a clear relationship between signs and symptoms. An evaluation showing no correlation between signs and symptoms usually indicates that the patient's problem originates from outside the musculoskeletal system and that the mechanical forms of treatment such as manipulation are unlikely to help.

Manipulation is best used for intraarticular movement restrictions. Extraarticular movement restrictions typically do not respond to joint manipulation and are best treated with slower, non-thrust joint mobilizations and soft tissue stretching techniques. If part of an extraarticular structure (e.g., the joint capsule) lies within the joint, it is regarded as intraarticular.

In the spine, traction-manipulation is directed to the intervertebral joint (i.e., the disc joint) rather than to the facet joints. Traction manipulation targeting a spinal facet joint can induce harmful rotational forces into the intervertebral joint, especially in the

1 The terms "musculoskeletal system" and "neuromusculoskeletal system" are widely used in reference to manual treatment. However, one cannot treat a "skeleton". It would be more accurate to use the terms "arthromuscular system" or "arthroneuromuscular system".

lumbar spine. The intervertebral disc is the most vulnerable intervertebral structure and should not be subjected to rotational stresses in a manipulative thrust. Spinal facet joint manipulations are not presented in this book.

Sacroiliac manipulations are advanced techniques and are not presented in this basic book. Only very skilled manipulative practitioners possess the speed and movement control necessary to manipulate the sacroiliac joint without producing incidental harmful rotational forces in the spine.

Contraindications

The most critical contraindication for manipulation may be the practitioner's level of skill and the extent of their clinical acumen. The high-velocity thrust of a manipulation is applied so quickly, the patient cannot interrupt it with a protective reaction or reflex.

The joint to be manipulated should display both restricted joint play and an abnormal end-feel. Hypomobility presenting with a normal end-feel and no symptoms is not considered pathological and should not be manipulated. These normal anatomical variations are frequently mistaken as joint restrictions by novice practitioners.

Hypomobility presenting with a normal end-feel and no symptoms, is not considered pathological and should not be manipulated.

General contraindications for manipulation are the same as for Grade III stretch mobilization, and relate primarily to health problems that reduce the body's tolerance to mechanical forces. In addition, traction-manipulation is contraindicated in the following cases:

- Decreased joint play with a hard, nonelastic end-feel (e.g., "bone-to-bone" stop).
- Increased joint play with a very soft, elastic end-feel (e.g., hypermobile joint).
- Pain or protective muscle spasm during traction testing or mobilization (e.g., empty end-feel).

The end-feel contraindications for manipulation are the same as for Grade III mobilizations, and can be found in the books *Manual Mobilization of the Joints: Volume I, The Extremities* and *Volume II, The Spine*.

Indications

It is impossible for students of manual therapy to determine when to manipulate, and when not to manipulate, until they develop the palpation sensitivity required to accurately assess joint end-feel. It can take an individual years to develop this skill. Some practitioners never achieve it, and should restrict their manipulative practice to low-risk traction techniques.

Manipulation for intraarticular restrictions

Joint end-feel provides the most useful and reliable indication for joint manipulation. Manipulation is effective for intraarticular restrictions that present a firmer end-feel than is normal. In this case the end-feel is less elastic, more firm, and usually appears earlier in the range than in a normal joint (i.e., hypomobile joint). In this case the manipulation has a mechanical effect on releasing the hypomobile joint.

If the joint restriction is associated with a joint-related muscle spasm, a successful manipulation can relax the spasm with a neurological effect. Conversely, if the muscle's connective tissue is shortened, a joint manipulation will not be successful. In this case the connective tissue must be stretched using other techniques.

Many joint conditions that do not respond to mobilization treatment, can be successfully treated with manipulation. No matter how skillfully the mobilization is applied, and no matter how long or how often the treatment, mobilization by its very nature has some limitations in efficacy.

Diagnostic manipulation

A *hypermobile* joint locked in a positional fault can present as a *hypomobile* joint. Upon passive motion testing, it is usually not possible to differentiate a locked hypermobile joint from a hypomobile joint. A trial treatment with traction-manipulation can “unlock” the positional fault and reveal the underlying hypermobility.

Measuring progress

The practitioner determines the efficacy of manipulative therapy treatment through the reassessment of key signs and symptoms using valid and reliable measures for pain and functional impairment. (See *Volume 1: Extremities* and *Volume 2: Spine* for a more thorough review of reassessment procedures.)

Improvement in the range of restricted joint gliding is one of the most useful findings for reassessment after treatment by manipulation. Since the roll-gliding in all joint movements begins with a short initial gliding motion before the rolling component

commences, it is important to determine the specific direction of decreased gliding for reassessment purposes, even if the manipulation treatment is in a traction direction. If there is a distinct, easy-to-feel joint play restriction in a particular direction, this movement direction can be used as a key sign to monitor treatment efficacy.

While one can learn to read musical notes in a day, it takes many years of study and practice to become a musician. The same can be said of joint manipulation. It takes many years to develop the clinical acumen, sensitive feel and explosive speed which are the hallmark of the master manipulative practitioner. An alarming number of manual therapists have the mistaken belief they can acquire manipulative skill through reading and a few hours of instruction on a short course. This is not possible. More importantly, it is dangerous.

A common misconception among manual therapists is that manipulation is a “continuation” of a stretch-mobilization or a further movement at the end of a prolonged mobilization. Manipulation is fundamentally different from mobilization. A manipulative thrust is always quick, is never under the patient’s control, is always initiated from the Actual Resting Position, and primarily impacts intraarticular restrictions. A joint mobilization is always slow, can be initiated from any joint position (not only the Actual Resting Position) to stretch specific intraarticular or extraarticular tissues, and is always under the patient’s control. It is not unusual for practitioners skilled in joint mobilization to have difficulty with manipulative thrusts, and vice versa.

■ Pre-manipulative procedures

The joint must have an end-feel suitable for manipulation. In cases where the joint end-feel is too restricted or when associated soft tissue restrictions interfere with a manipulative maneuver, it may be necessary to prepare the joint with other treatments. The joint can be loosened over a period of time in the days preceding the manipulation with the application of joint mobilization, soft tissue treatment (e.g., muscle stretching, functional massage), acupuncture or acupressure, therapeutic exercise, or therapeutic modalities (e.g., heat, cold, electrotherapy).

At the time of the manipulation the patient should be as relaxed as possible. The same adjunctive treatments used to prepare the joint in the days preceding the manipulation, can also be used immediately prior to the manipulation treatment to warm and loosen the area and facilitate relaxation.

■ Application of the thrust

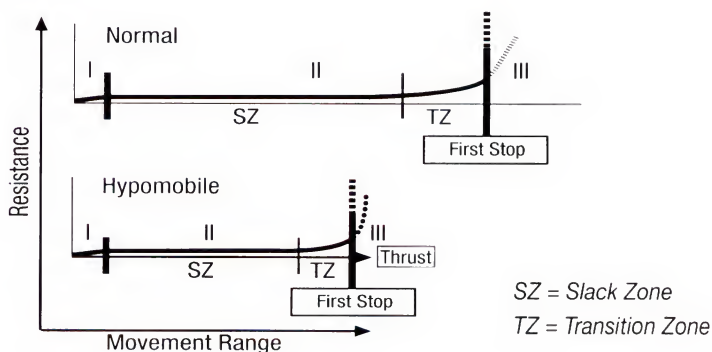
1. Confirm that the end-feel is suitable for manipulation.
2. Place the targeted joint in the Actual Resting Position.
3. Establish the line of drive for the thrust.
4. Apply the traction-manipulation with the requisite quickness, amplitude, grade, timing, and force.

1. Confirm that the end-feel is suitable for manipulation

Manipulation is indicated when there is a pathological end-feel that is less elastic and more firm than normal. The pathological end-feel is judged to be less elastic if the movement does not rebound back to its First Stop when the testing pressure is released. The end-feel will be quite firm, or “almost” hard (e.g., “Firm++”).

In most cases, an end-feel suitable for manipulation is also associated with limited range of motion. It is possible for the range-of-motion to appear normal, but present with symptoms and a firmer end-feel suitable for manipulation. Conversely, there are joints with reduced range of motion which are asymptomatic and present with a normal end-feel. These are normal anatomical variations, and should not be manipulated in an attempt to increase range of motion.

Figure 2.1
Normal and hypomobile
movement range with
altered end-feel



- **Normal joint end-feel.** It is possible to manipulate a normal, asymptomatic joint, but this is ineffective and unnecessary.
- **Pathological firm, inelastic joint end-feel.** A pathological end-feel is usually associated with symptoms and decreased range of motion (i.e., hypomobile), and may respond to manipulation treatment.
- **Hard joint end-feel.** Manipulation is contraindicated.

Joints with reduced range of motion that are asymptomatic and present with a normal end-feel, are normal anatomical variations and should not be manipulated in an attempt to increase range of motion.

A goal of manipulation is to normalize end-feel. In a restricted joint, normalization of the end-feel often moves the abnormal First Stop from a shortened range to a normal range.

Pathological end-feel findings can be subtle and may be apparent only to the most skilled practitioner. A symptomatic joint may appear to have normal range of movement to the novice, while the experienced practitioner will discover an abnormal end-feel with a slight movement restriction. A novice usually needs an immediate and careful comparison with a normal joint to recognize the pathological characteristics of an end-feel. A novice may inappropriately judge that a joint with less than expected range of movement requires treatment, while a skilled practitioner recognizes the same joint to have a normal end-feel.

2. Place the targeted joint in the Actual Resting Position

The *Actual (or Momentary) Resting Position* may vary considerably from the Normal Resting Position. In the presence of symptoms or pathological changes within the joint or in the associated body region, it may be impossible, difficult or impractical to assume the Normal Resting Position. Careful observation of the patient's habitual posture can give you an approximate regional posture from which you can begin to explore the Actual Resting Position of the joint to be manipulated.

Since the Actual Resting Position can change from moment to moment as a result of handling, positional changes, the treatment itself, and a variety of other factors, it should be assessed immediately prior to *every* manipulative procedure. (See *Chapter 3: How to find the Actual Resting Position in the extremity joints*, and *Chapter 4: How to find the Actual Resting Position in the spine*.)¹

With rotational and locking techniques, there is a tendency for novice practitioners to “overwind” when positioning a joint for manipulation (i.e., position the joint beyond the first stop), so that no manipulation or movement can occur. “Overwinding” not only hinders movement, but can also produce harmful compression forces in the joint and result in unintended trauma to intraarticular and extraarticular structures.

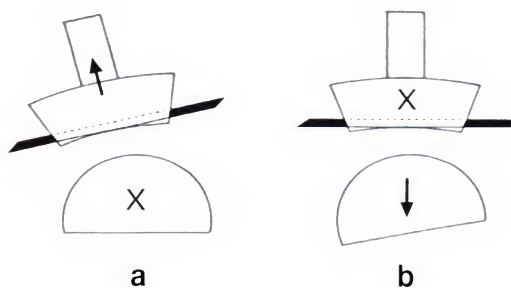
¹ Joint positioning for manipulation begins in the Actual Resting Position, and joint slack is taken up from that starting point. This is in contrast to joint positioning for slow stretch-mobilization, where the starting point is often outside the Actual Resting Position (a “pre-stretch” position) close to the point of restriction.

Students of manipulation may not yet feel when they move a joint beyond the first stop, and thus their attempts to mobilize or manipulate will fail. Without skilled supervision these students resort to more force when instead they should be more gentle in their positioning and/or quicker with their thrust. At this stage of learning, students should limit their practice of manipulation to translatory *traction* techniques. If students attempt more advanced manipulation techniques with special positions that “lock” joints above and below a targeted spinal segment, they often also lock the segment to be manipulated. The result is ineffective at best and can also be harmful to the patient.

3. Establish the line of drive

The line of drive (i.e., treatment direction) for a traction-manipulation lies at a right angle to the Treatment Plane through the concave joint partner.

Figure 2.2
The line of drive lies at a right angle to the Treatment Plane through the concave joint partner.



- a) **If the traction-manipulation is applied to the concave joint partner**, the line of drive follows the orientation of the *moving* concave joint partner, for example, when treating the finger, elbow, and knee joints, and most cervical and thoracic segments treated from a *cranial* orientation. The line of drive direction changes if the orientation of the concave joint partner changes.
- b) **If the traction-manipulation is applied to the convex joint partner**, the line of drive follows the orientation of the *fixed* concave joint partner, for example, when treating the wrist, shoulder, and ankle joints, and lumbar segments when treated from a *caudal* orientation. In this case, the direction of the thrust remains the same even if the convex joint partner changes position.

4. Apply the traction-manipulation thrust

◆ quickness ◆ amplitude ◆ grade ◆ timing ◆ force ◆

A manipulative thrust is a high-velocity, low-amplitude impulse applied spontaneously at the instant the practitioner senses that the joint relaxes and is ready to go. It takes place as if by reflex.

Quickness

Quickness is the most important element of the manipulation.

The practitioner must already be in position with correct contact pressures and line of drive, so that the moment the joint reaches its manipulative window the practitioner can instantly react with the thrust. There is no time for the practitioner to think at this point. Practitioners who think about the thrust as a step-by-step movement will not develop sufficient speed to be successful.

It is quickness that distinguishes a manipulation from a mobilization. The thrust occurs so quickly it is not possible for the patient to interrupt it. The patient has no chance to provide feedback about pain as the thrust is applied. Patient feedback can only occur during premanipulative procedures. The therapist must be certain of the indications for the thrust prior to initiating the thrust.

Techniques without fixation must be *extremely* quick to produce a local effect. Slower movements have a more general effect and can impact neighboring joints with unwanted movement. Speed is particularly important with cervical and lumbar manipulations applied without fixation. For example, if a traction-manipulation intended for the upper cervical spine is performed too slowly, it may instead produce unwanted movement in the lower cervical spine or even into the thoracic region, especially if the movement is large.

Some practitioners skilled in mobilization techniques have difficulty breaking the “slow mobilization habit” and never develop the quickness to become a skilled manipulator. In order to produce a quick movement, a manipulative thrust is typically generated by isolated muscles in the practitioner’s arm or shoulder rather than by the practitioner’s body. This is in contrast to mobilization techniques in which slow movements are produced by movement of the practitioner’s entire body. It is important that practitioners learn to isolate these muscles to generate the small, explosive, spontaneous impulse required for an effective thrust.

Practitioners who are unable to generate the necessary speed for a successful manipulative thrust, must rely on slower mobilization

techniques for patient treatment and should restrict their manipulative practice to traction techniques that are safe even if performed with inadequate quickness. While the beneficial neurological reflex effects of manipulation do not occur with mobilization techniques, skillfully applied mobilization is effective for other joint disorders.

Amplitude

Amplitude is the second-most important element of the manipulation.

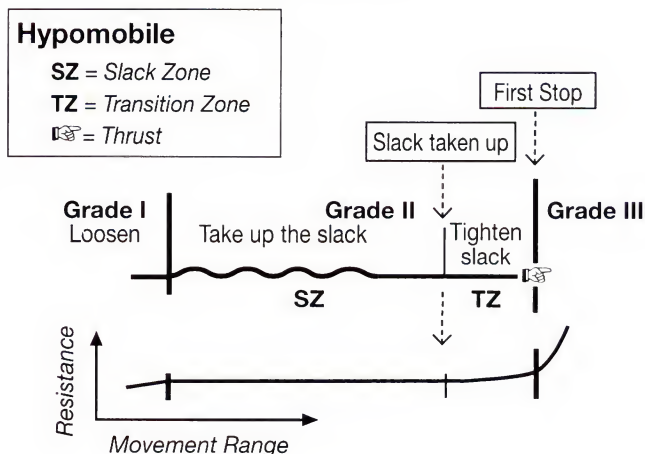
The amplitude (length) of movement that is produced in a manipulative thrust is so small, there may be no perceptible movement in the joint. The movement is no more than a quick impulse applied after the slack is tightened to the First Stop. An extremely small movement amplitude is essential to prevent damage to the joint tissues and surrounding structures with such a rapid thrust.

The impulse of the thrust stops as quickly as it starts, like a “contained explosion.” When learning manipulation, it is useful to think the words “Go” and “Stop” at the same time (i.e., say, “Go-Stop” as a single word) upon initiating the thrust.¹

Grade

The traction thrust is applied precisely when the slack has been taken up and *tightened* at the start of the pathological (restricted) Grade III range, called the “First Stop”.

Figure 2.3
Traction-thrust is applied
precisely at the start of the
restricted First Stop



¹ In Norway, the word “ballotere” describes a movement that is stopped suddenly by an antagonist muscle. A manipulative thrust is a “ballotere” movement that stops *immediately* after it starts. There is no equivalent word in the English language, so we created one: “Go-Stop”. It is helpful for the novice practitioner to think of these two words as one (i.e., “GoStop”) when practicing a manipulative thrust.

A common misconception among manual therapists, is that a manipulation is a continuation of a stretch-mobilization.

Manipulation is not applied at the end of a prolonged stretch-mobilization. It is true that the practitioner can first confirm that the patient can safely tolerate a manipulation by applying a brief Grade III stretch-mobilization. However, after this stretch-mobilization “screening test,” the stretch is released back into the Grade II range before slowly taking up the slack again, this time tightening the tissues through the Transition Zone up to the restricted Grade III range and immediately applying the thrust at the point of the actual pathological stop.

It is often useful to start all over again after applying the stretch-mobilization screening test in order to create a mental separation between a “mobilization mind set” and a manipulation.

In practice, the thrust is a continuation of slower translatory movement from the Actual Resting Position. The practitioner first takes up the slack in the Slack Zone (SZ) and continues to tighten the slack through the Transition Zone (TZ). The thrust is initiated the instant the practitioner senses marked resistance at the start of the momentary Grade III range.

A common error of novices is to thrust “at a run” through the TZ into the Grade III range. A practitioner’s ability to apply an effective traction thrust requires the ability to detect and instantaneously react at the moment the movement approaches the marked resistance of the First Stop.

Timing

In order for a manipulative thrust to be applied successfully, the contractile tissues surrounding it must be fully relaxed while taking up the slack and at the moment of the thrust. Relaxation is facilitated in the seconds immediately preceding the manipulation with a variety of techniques, including reflex facilitation and inhibition techniques (e.g., hold-relax/direct action; contraction of antagonists/reciprocal inhibition), breathing maneuvers, and precise positioning.

Manipulation is contraindicated when the tissues surrounding the joint are not completely relaxed.

Some patients with significant pain or tension find relaxation difficult, especially when being handled, prodded, tested and moved by a manual therapist. Slow mobilizations and joint movements can aggravate their pain and increase their muscle guarding response.

If such patients can relax even for a second, a skilled manipulator can apply a thrust in that instant of opportunity to provide the patient with relief. Skilled practitioners sometimes distract the patient's attention with a verbal comment or suggestion, and in that moment of distraction find a split-second of opportunity to apply a manipulative thrust. A less skilled practitioner treating the same patient, is likely to find high-velocity maneuvers impossible.

Force

In a manipulative thrust, the practitioner uses the least possible force necessary to achieve the desired effect. The more skilled a practitioner becomes with palpation, tightening the slack, sensing end-feel, timing, positioning and movement coordination, the less force is needed.

The exact force required for an effective manipulative thrust is impossible to ascertain with certainty. Various joints, variations in individual anatomy, and different types and stages of joint pathology, characteristically require more or less thrusting force. A joint in a child may only require a force of 5 Newtons, whereas a large joint in an adult may require a force of 40 or 50 Newtons. Therapeutic manipulation for hypomobility requires relatively more force than manipulations used as a trial treatment or to differentiate an acutely fixated hypermobile joint from a longer standing hypomobility. The best guideline for practitioners is to use as much force as necessary and as little force as possible.

There is no shortcut to learning how to determine the optimal force for a particular manipulation. Only time and experience can teach this, with hands-on guidance from an experienced clinical instructor.

■ Treatment progression

Changes in the patient's condition are assessed by monitoring changes in one or more dominant symptoms and signs. If reassessment reveals normalization of joint function along with decreased symptoms, treatment should be stopped for that day.

It can take more than one attempt at manipulation to achieve success. If the first attempt is unsuccessful and reassessment reveals no improvement, the practitioner can try again with variations in technique (e.g., with better patient relaxation, changes in timing, positioning, direction of force, etc.) or a different technique.

If a second attempt at manipulation is unsuccessful, or if the patient's condition is worsened, reevaluation is necessary and may lead to a change in treatment.

Some patients benefit from a series of manipulation treatments over time. As long as reassessment confirms that the patient improves with each treatment, there is no harm in repeating the same manipulation in subsequent treatment sessions. Periodic treatment with manipulation is often useful in cases when self-treatment measures (e.g., home exercise) is not adequate to maintain joint function. Periodic manipulation treatments over time are also helpful in chronic cases (e.g., ankylosing spondylitis) to help maintain joint function.

If there is no change after three treatments with manipulation, it makes little sense to continue. At this point the practitioner must determine whether another form of treatment is indicated. In some cases the patient might yet benefit from manipulation delivered by a specialist with more advanced manipulative skill. Unfortunately, patient referrals to colleagues with specialty training is discouraged in some clinical settings, to the detriment of quality patient care.

■ Post-manipulative procedures

Appropriate after-manipulation care and patient instruction follows the same OMT guidelines as for other manual therapy techniques. Following manipulation, additional treatment or special management of the condition may be necessary. Some joint conditions benefit from a period of rest after the manipulation, while other conditions benefit from therapeutic exercise in the area where the manipulation was applied. Patient instruction in prophylaxis helps prolong the positive effects of the treatment and reduces the risk of recurrence.

With proper OMT management combined with manipulative treatment, the patient often completes the course of care in a healthier state than they were before the episode that brought them to treatment.

■ Notes

TECHNIQUES

■ Notes

How to find the Actual Resting Position in the extremities

Example: MCP Joint

- 1) Begin your exploration of the Actual Resting Position by positioning the joint in a typical resting position according to established norms. For example, the Normal Resting Position for the MCP is slight palmar flexion and slight ulnar flexion. If you observe that the patient presents with an atypical resting position (e.g., holding their fingers in marked ulnar flexion), then begin your exploration there.
- 2) In this approximate resting position, apply several gentle Grade II traction joint play tests to the first stop, feeling for the ease and degree of movement.
- 3) Reposition into slightly more or less flexion/extension and apply the traction tests again until you locate the position with the greatest ease and degree of movement. Maintain this position as you proceed to the next step.
- 4) Repeat the traction tests with subtle repositioning into more or less abduction/adduction and apply the traction tests again until you locate the position with greatest ease and degree of movement. Maintain this flexion/extension and abduction/adduction position as you proceed to the next step.
- 5) Repeat the traction tests with subtle repositioning into more or less rotation (internal and external) until you find the position with the greatest ease and range of movement in all three dimensions.

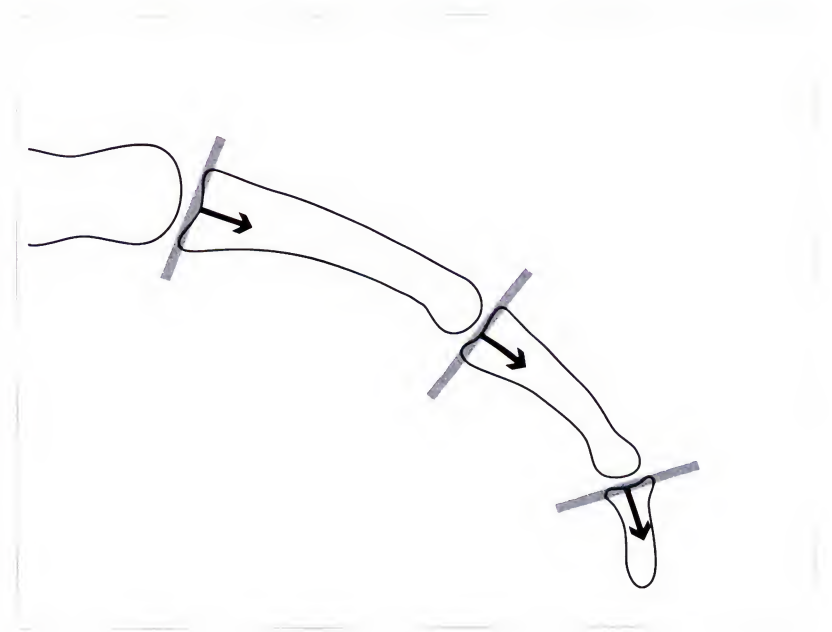
This is the *Actual Resting Position* for this patient, at this moment in time.

Comments

- The Actual Resting Position may vary considerably from the Normal Resting Position due to pathological changes and as a response to therapeutic intervention.
- Experienced practitioners may speed their exploration of the Actual Resting Position with simultaneous joint re-positioning in multiple planes.
- The direction of the final traction test (see #5 above) establishes the orientation of the line of drive for traction-manipulation. The Treatment Plane lies at a right angle to it.

Finger

DIP, PIP and MCP joints



Normal Resting Position

- *DIP and PIP*: Slight palmar flexion in all joints.
- *MCP*: Slight palmar flexion, and in some cases slight ulnar flexion.

Actual Resting Position

- May be quite different from the Normal Resting Position in the presence of pathology.

Line of drive for traction-manipulation

- The line of drive lies at a right angle to the Treatment Plane on the concave joint surface of the phalanx, along the long axis of the bone. When manipulation techniques are applied with proximal fixation, the metacarpal bone or more proximal phalanx remains fixed and the *orientation of the line of drive changes* to follow position changes of the more distal phalanx.

Finger DIP, PIP and MCP joints

traction-manipulation



Figure 1a - 2nd MCP
with finger fixation against the body



Figure 1b - 5th MCP
with thenar fixation on a wedge

■ Figure 1a - With body fixation

Set up

- **Patient position:** Sitting with the finger in the Actual Resting Position.
- **Fixation grip:** With your left hand, grip the patient's metacarpal bone and hand just proximal to the targeted joint space. (For the DIP and PIP joints, grip the finger.) Fixate the patient's hand against your body.
- **Movement grip:** With your right hand, grip the patient's finger distal to the targeted joint space.

Procedure

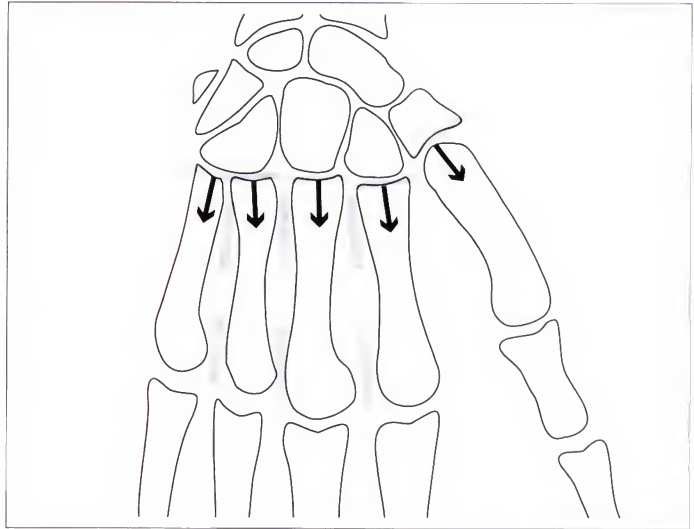
- Apply joint play tests and relaxation techniques as necessary to insure that the targeted joint is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With distal movement of the phalanx, gently tighten joint slack through the Transition Zone, following the line of drive through the long axis of the phalanx. Without pause, apply a distal thrust the instant you sense marked resistance to the passive tightening movement.
- Reassess key signs.

■ Figure 1b - With wedge fixation

- **Patient position:** Place the dorsal side of the patient's hand on a treatment wedge.
- **Fixation grip:** With your left hand, fixate the proximal joint partner against the wedge with your thenar eminence just proximal to the targeted joint space.

Hand Proper

Carpometacarpal joints



Normal Resting Position

- *1st carpometacarpal joint*: Midway between abduction-adduction and flexion-extension.
- *2nd - 5th carpometacarpal joints*: Relaxed.

Actual Resting Position

- *1st carpometacarpal joint*: May be quite different from the Normal Resting Position in the presence of pathology.

Line of drive for traction-manipulation

- *Flexion/extension of the 1st carpometacarpal joint and the 2nd - 5th carpometacarpal joints*: The line of drive lies at a right angle to the Treatment Plane on the concave joint surfaces of the metacarpals, along the long axis of the bones. When manipulation techniques are applied with proximal fixation, the carpal bone remains fixed and the *orientation of the line of drive changes* to follow position changes of the metacarpal bone.
- *Abduction/adduction of the 1st carpometacarpal joint*: The line of drive lies at a right angle to the Treatment Plane on the concave joint surface of the trapezium (shown). When manipulation techniques are applied with proximal fixation, the trapezium remains fixed and the *orientation of the line of drive remains fixed* as the position of the 1st metacarpal changes.

Carpometacarpal joint *traction-manipulation*



Figure 2a - 3rd metacarpal;
with finger fixation on a wedge



Figure 2b - 3rd metacarpal;
with thenar fixation on a wedge

■ Figure 2a - With finger fixation on a wedge

Set up

- **Patient position:** Sitting with the hand in the Actual Resting Position.
- **Fixation grip:** With your left hand, grip around the targeted carpal bone (capitate shown) just proximal to the joint space. Fixate the bone against the treatment wedge.
- **Movement grip:** With your right hand, grip the patient's metacarpal bone. Ideally, the practitioner grips as close as possible to the targeted joint space. However, in this case, depending on the size of the patient's hand and the practitioner's hand, it may be more practical to grip just proximal to the metacarpal head (as shown).

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted joint is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With distal movement of the metacarpal bone, gently tighten joint slack through the Transition Zone, following the line of drive through the long axis of the metacarpal bone. Without pause, apply a distal thrust the instant you sense marked resistance to the passive tightening movement.
- **Reassess** key signs.

■ Figure 2b - With thenar fixation on a wedge

- **Fixation grip:** Use your left thenar eminence to fixate the patient's carpal bone against a treatment wedge.

1st carpometacarpal joint

traction-manipulation



Figure 3a - finger grip
with finger fixation against the body



Figure 3b - thenar grip
with finger fixation on a table

Figure 3a - With finger fixation against the body

Set up

- **Patient position:** Sitting with the thumb in the Actual Resting Position.
- **Fixation grip:** With your left hand, grip the patient's trapezium just proximal to the joint space. Fixate the patient's hand against your body.
- **Movement grip:** With your right hand, grip the patient's 1st metacarpal just distal to the joint space.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted joint is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With distal movement of the 1st metacarpal bone, gently tighten joint slack through the Transition Zone, following the line of drive. (For flexion/extension, the line of drive follows the long axis of the metacarpal bone. For abduction/adduction, the line of drive is at a right angle to the Treatment Plane on the fixated trapezium.) Without pause, apply a distal thrust the instant you sense marked resistance to the passive tightening movement.
- **Reassess** key signs.

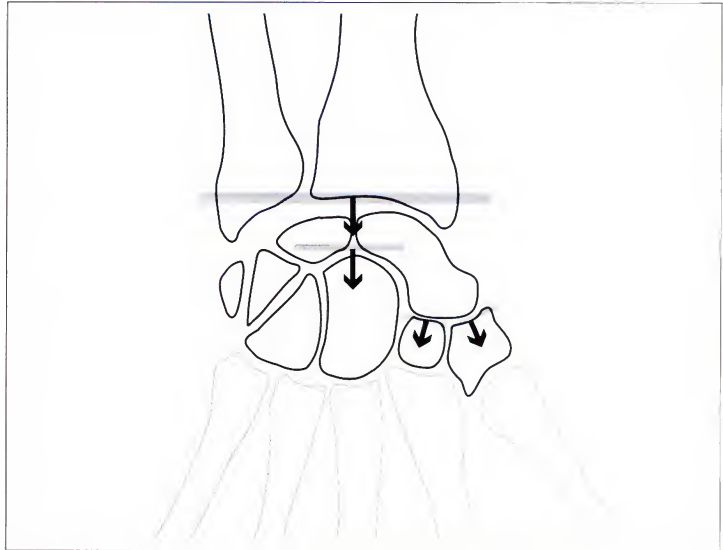
■ Figure 3b- With finger fixation on a table

- **Patient position:** The ulnar side of the patient's hand rests on the treatment table.
- **Fixation grip:** With your left hand, fixate the patient's trapezium just proximal to the joint space with your thumb on the palmar surface and your index finger on the dorsal surface.
- **Movement grip:** With your right hand grip around the 1st metacarpal with your thenar eminence and fingers.

■ Notes

Wrist

Radiocarpal and intercarpal joints



Normal Resting Position

- *Radiocarpal joint*: Slight palmar flexion and slight ulnar flexion.

Actual Resting Position

- May be quite different from the Normal Resting Position in the presence of pathology.

Line of drive for traction-manipulation

- *Radiocarpal and intercarpal joints*: The line of drive lies at a right angle to the Treatment Plane on the concave joint surface of the radius (or the concavity formed by the triquetrum, lunate and scaphoid). When manipulation techniques are applied with proximal fixation, the radius or more proximal carpal bone remains fixed and the *orientation of the line of drive remains fixed* as the position of the wrist changes.
- *Joints between the two trapezii and scaphoid*: The line of drive lies at a right angle to the Treatment Plane on the concave joint surfaces of the trapezii. When manipulation techniques are applied with proximal fixation, the *orientation of the line of drive changes* to follow position changes of the trapezii.

Wrist joints

traction-manipulation



Figure 4a - radiocarpal joint
with fixation against the body



Figure 4b - radiocarpal joint
with wedge fixation

■ Figure 4a - With fixation against the body

Set up

- **Patient position:** Sitting with the wrist in the Actual Resting Position.
- **Fixation grip:** With your left hand, grip the patient's forearm just proximal to the joint space. Fixate the patient's forearm against your body.
- **Movement grip:** With your right hand, grip the patient's hand just distal to the wrist joints.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted joint is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With distal movement of the hand, gently tighten joint slack through the Transition Zone, following the line of drive through the long axis of the forearm. Without pause, apply a distal thrust the instant you sense marked resistance to the passive tightening movement.
- **Reassess** key signs.

■ Figure 4b - With wedge fixation

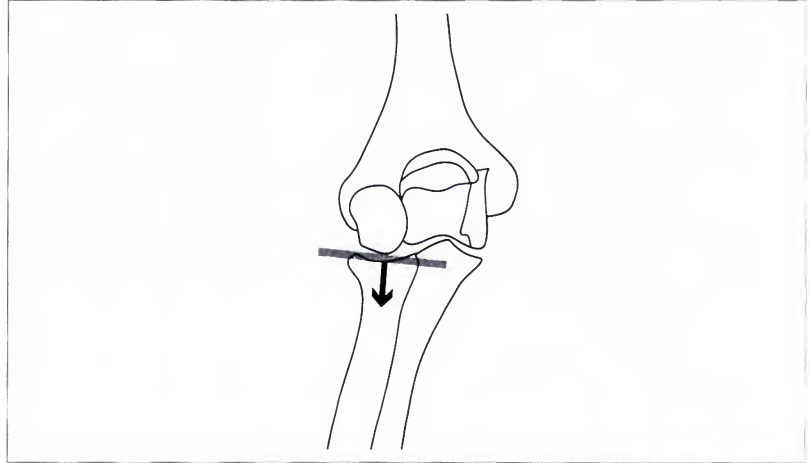
- **Patient position:** The anterior side of the patient's forearm rests on a treatment wedge.
- **Fixation grip:** With your left hand, fixate the patient's forearm just proximal to the joint space.

■ (Not shown) - Joints between the proximal and distal carpal rows

- Modify your grip to apply more specific traction between the proximal and distal carpal rows.

Forearm

Humeroradial joint



Normal Resting Position

- Forearm supination with elbow extension.

Actual Resting Position

- May be quite different from the Normal Resting Position in the presence of pathology.

Line of drive for traction-manipulation

- The line of drive lies at a right angle to the Treatment Plane on the concave joint surface of the radius, along the long axis of the bone. When manipulation techniques are applied with proximal fixation, the humerus remains fixed and the *orientation of the line of drive changes* to follow position changes in the radius.

Humero radial joint *traction-manipulation*



Figure 5a - fixation on a table
with medial grip



Figure 5b - fixation on a table
with anterior grip

■ Figure 5a - With medial fixation

Set up

- **Patient position:** Supine with the forearm in the Actual Resting Position.
- **Fixation grip:** With your right hand, grip the patient's upper arm from the medial side just proximal to the joint space. Fixate the patient's upper arm against the treatment table.
- **Movement grip:** With your left hand, grip the patient's radius just distal to the joint space.

Procedure

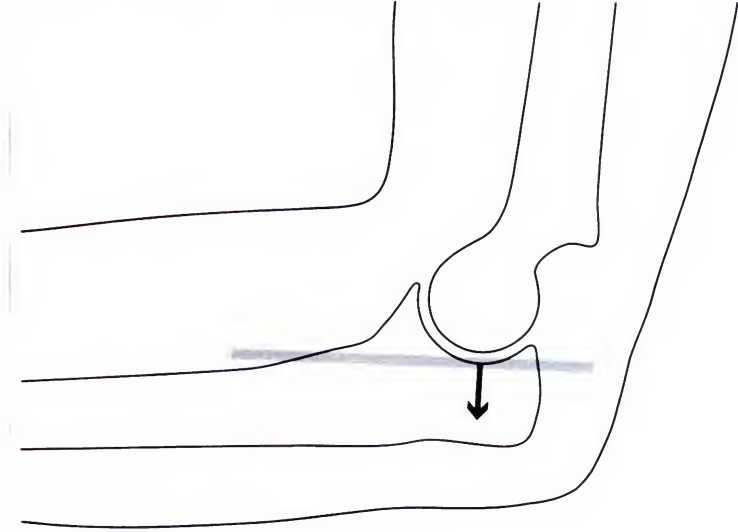
- Apply joint play tests and relaxation techniques as necessary to insure that the targeted joint is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With distal movement of the radius, gently tighten joint slack through the Transition Zone, following the line of drive through the long axis of the radius. Without pause, apply a distal thrust the instant you sense marked resistance to the passive tightening movement.
- **Reassess** key signs.

■ Figure 5b - With anterior fixation

- **Fixation grip:** With your right hand, grasp the anterior aspect of the patient's upper arm and fixate it against the treatment table. Place your palpating finger in the joint space.
- **Movement grip:** With your left hand grip around the patient's distal radius.

Elbow

Humero-ulnar joint



Normal Resting Position

- Approximately 70° elbow flexion and 10° forearm supination.

Actual Resting Position

- May be quite different from the Normal Resting Position in the presence of pathology.

Line of drive for traction-manipulation

- The line of drive lies at a right angle to the Treatment Plane, which is almost parallel to the forearm on the concave joint surface of the ulna. When manipulation techniques are applied with proximal fixation, the humerus remains fixed and the *orientation of the line of drive changes* to follow position changes in the ulna.

Humero-ulnar joint *traction-manipulation*



Figure 6a
with hand fixation



Figure 6b
with table fixation

■ Figure 6a - With hand fixation

Set up

- **Patient position:** Sidelying or sitting with the elbow in the Actual Resting Position.
- **Fixation grip:** With your left hand, grip the patient's distal humerus from the dorsal side. Fixate the patient's upper arm against the treatment table and the patient's body.
- **Movement grip:** With your right hand, grip the patient's proximal ulna from the ulnar side.

Procedure

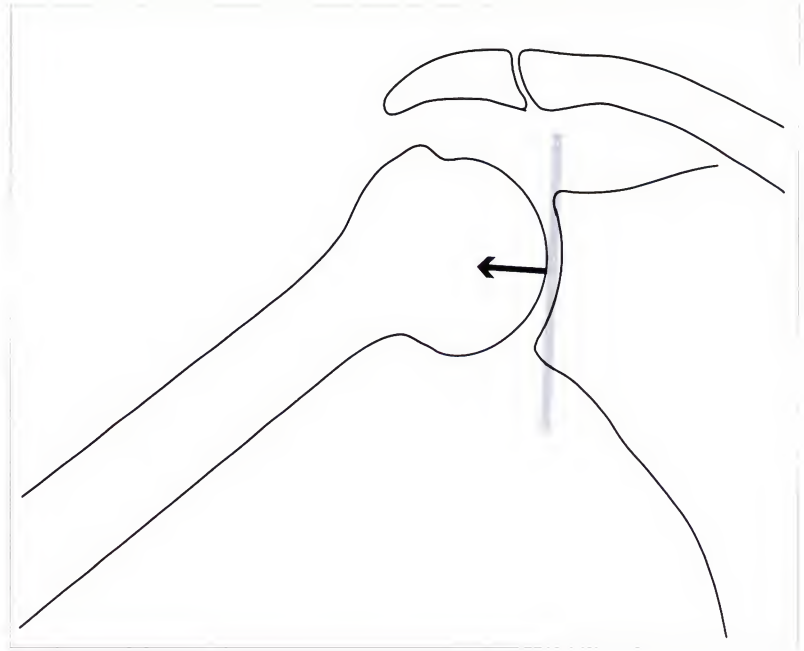
- Apply joint play tests and relaxation techniques as necessary to insure that the targeted joint is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With posterior movement of the ulna, gently tighten joint slack through the Transition Zone, following the line of drive at a right angle to the Treatment Plane and approximately perpendicular to the long axis of the forearm. Without pause, apply a posterior thrust the instant you sense marked resistance to the passive tightening movement.
- Reassess key signs.

■ Figure 6b - With table fixation

- **Patient position:** Sidelying with the elbow in the Actual Resting Position.
- **Fixation grip:** The patient's upper arm is fixated by the treatment table and the patient's body.
- **Movement grip:** Grip the patient's forearm from the ulnar side with your hands and your left hypothenar eminence just distal to the joint space.

Shoulder

Glenohumeral joint



Normal Resting Position

- Approximately 55° shoulder abduction and 30° horizontal adduction. The humerus lies near a horizontal plane passing through the spine of the scapula, with the elbow in flexion and the forearm near the horizontal plane.

Actual Resting Position

- May be quite different from the Normal Resting Position in the presence of pathology.

Line of drive for traction-manipulation

- The line of drive lies at a right angle to the Treatment Plane on the concave joint surface of the glenoid fossa. When manipulation techniques are applied with proximal fixation, the scapula remains fixed and the *orientation of the line of drive remains fixed* as the position of the humerus changes.

Glenohumeral joint

traction-manipulation



Figure 7a - in sitting
with hand fixation



Figure 7b - in supine
with straps for fixation and movement

■ Figure 7a - In sitting

Set up

- **Patient position:** Sitting with the shoulder in the Actual Resting Position.
- **Fixation grip:** With your left hand, grip the patient's scapula and acromion from the dorsal/superior side. Fixate the scapula by pressing downward toward the patient's body.
- **Movement grip:** Support the patient's forearm on your right forearm. With your right hand, grip the patient's proximal humerus from the medial side.

Procedure

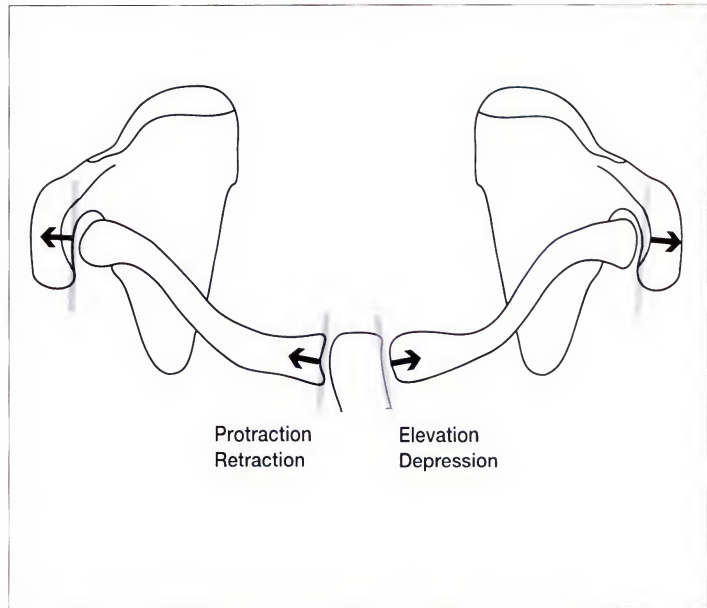
- Apply joint play tests and relaxation techniques as necessary to insure that the targeted joint is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With lateral movement of the humerus, gently tighten joint slack through the Transition Zone, following the line of drive at a right angle to the Treatment Plane. Without pause, apply a lateral thrust through the humerus the instant you sense marked resistance to the passive tightening movement.
- Reassess key signs.

■ Figure 7b - Supine with straps

- **Fixation:** Fixate the patient's thorax and scapula against the treatment table with a strap.
- **Movement grip:** Place a strap around the proximal humerus just distal to the joint space and around your body. Grip the patient's humerus with your right hand underneath the strap. Support the patient's elbow with your left hand.
- **Traction-manipulation:** Lean backward with your body to take up joint slack. Use your arms to apply the thrust while controlling joint tightening with your body.

Shoulder girdle

Sternoclavicular and acromioclavicular joints



Normal Resting Position

- Same as the zero position.

Actual Resting Position

- May be quite different from the Normal Resting Position in the presence of pathology.

Line of drive for traction-manipulation

- *Sternoclavicular elevation/depression*: The line of drive lies at a right angle to the Treatment Plane on the concave joint surface of the manubrium. When manipulation techniques are applied with proximal fixation, the sternum remains fixed and the *orientation of the line of drive remains fixed* as the position of the clavicle changes.
- *Sternoclavicular protraction/retraction*: The line of drive lies at a right angle to the Treatment Plane on the concave joint surface of the saddle-shaped clavicle. When manipulation techniques are applied with proximal fixation, the *orientation of the line of drive changes* to follow position changes in the clavicle.
- *Acromioclavicular joint*: The line of drive lies at a right angle to the Treatment Plane on the concave joint surface of the acromion.

Sternoclavicular and acromioclavicular joints

traction-manipulation



Figure 8a - in sitting with finger grip



Figure 8b - in supine with hand or thenar grip

■ Figure 8a - Sternoclavicular joint in sitting

Set up

- **Patient position:** Sitting with the shoulder girdle in the Actual Resting Position.
- **Fixation grip:** With your left hand, grip around the patient's sternum and thorax. Fixate the patient against your body.
- **Movement grip:** With your right hand, grip the patient's clavicle from the ventral side just lateral to the joint space.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted joint is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With lateral movement of the clavicle, gently tighten joint slack through the Transition Zone, following the line of drive through the long axis of the clavicle. Without pause, apply a lateral thrust through the clavicle the instant you sense marked resistance to the passive tightening movement.
- Reassess key signs.

■ Figure 8b - Sternoclavicular joint in supine

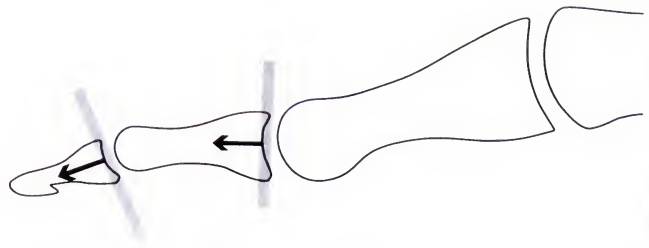
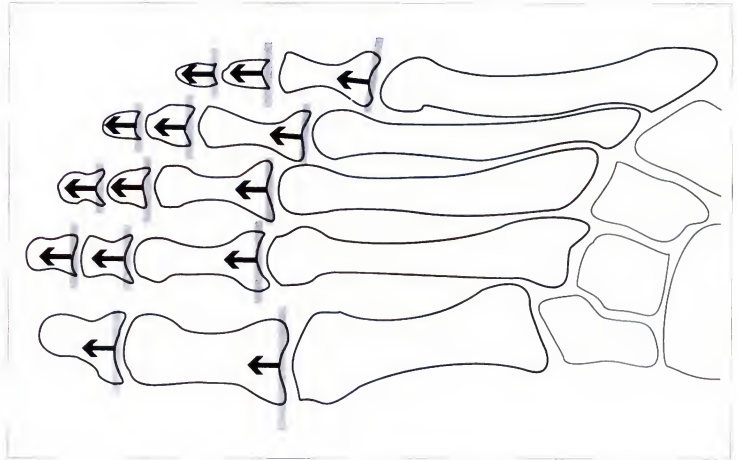
- Patient is supine with the shoulder girdle in the Actual Resting Position; with your right hand fixate the patient's sternum and thorax against the treatment table; with your left hand grip around the patient's shoulder with your thenar eminence just lateral to the joint space on the clavicle.

■ (Not shown) - Acromioclavicular joint in supine

- Modify your grip to treat the acromioclavicular joint with lateral movement.

Toes

DIP, PIP and MTP joints



Normal Resting Position

- *DIP and PIP joints:* Approximately 10° flexion.
- *MTP joints:* Approximately 10° extension from zero

Actual Resting Position

- May be quite different from the Normal Resting Position in the presence of pathology.

Line of drive for traction-manipulation

- The line of drive lies at a right angle to the Treatment Plane on the concave joint surface of the phalanx, along the long axis of the bone. When manipulation techniques are applied with proximal fixation, the metatarsal or more proximal phalanx remains fixed and the *orientation of the line of drive changes* to follow position changes of the more distal phalanx.

Toe DIP, PIP and MTP joints

traction-manipulation



Figure 9a - 1st MTP joint
with hand fixation against the body



Figure 9b - 1st MTP joint
with thenar fixation on a wedge

■ Figure 9a - With hand fixation

Set up

- **Patient position:** Supine with the toes in the Actual Resting Position.
- **Fixation grip:** With your left hand, grip the patient's toe and foot just proximal to the targeted joint space. Fixate the patient's foot against your body.
- **Movement grip:** With your right hand, grip the patient's toe just distal to the targeted joint space.

Procedure

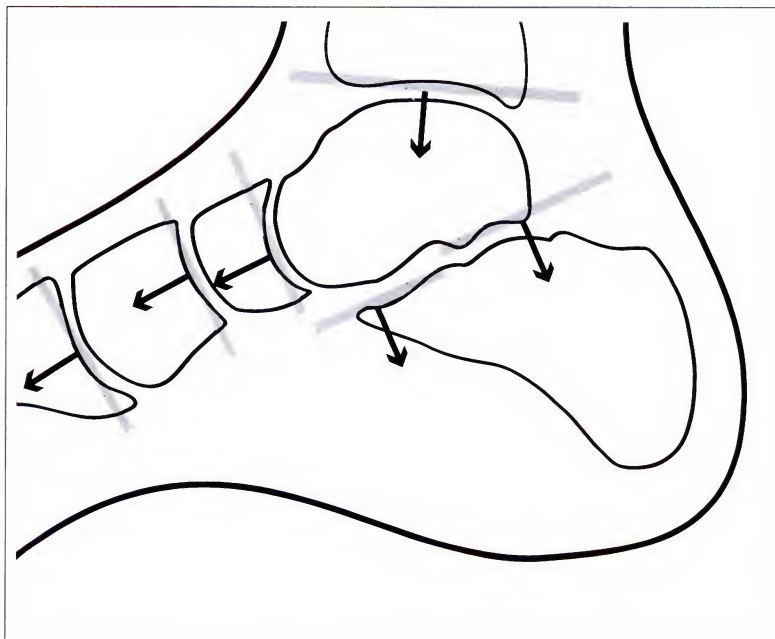
- Apply joint play tests and relaxation techniques as necessary to insure that the targeted joint is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With distal movement of the phalanx, gently tighten joint slack through the Transition Zone, following the line of drive through the long axis of the phalanx. Without pause, apply a distal thrust the instant you sense marked resistance to the passive tightening movement.
- **Reassess** key signs.

■ Figure 9b - With thenar fixation

- **Fixation:** Place the plantar side of the patient's foot on a treatment wedge, with the targeted joint outside the wedge. Fixate with your thenar eminence just proximal to the targeted joint space.

Foot and Ankle

tarsus and talocrural joints



Normal Resting Position

- *Talocrural joint*: Approximately 10° plantarflexion and midway between full eversion and full inversion.
- *Other foot joints*: Same as the zero position.

Actual Resting Position

- *Talocrural and other foot joints*: The Actual Resting Position may vary somewhat with normal structural variations (e.g., flat foot or high arch).

Line of drive for traction-manipulation

- *Joints on the medial side of the foot*: The line of drive lies at a right angle to the Treatment Plane on the concave joint surface of the more distal joint partner. When manipulation techniques are applied with proximal fixation, the *orientation of the line of drive changes* to follow position changes in the more distal bones.
- *Talocrural joint and subtalar joint (posterior talo-calcaneal joint)*: The line of drive lies at a right angle to the Treatment Plane on the concave surfaces of the tibia and talus.

Foot joints on the medial side

traction-manipulation



Figure 10a - cuneonavicular joint with fixation against the body



Figure 10b - cuneonavicular joint with fixation on a wedge

■ Figure 10a - Cuneonavicular joint with body fixation

Set up

- **Patient position:** Supine with the foot in the Actual Resting Position.
- **Fixation grip:** With your left hand, grip around the patient's foot and navicular bone just proximal to the joint space. Fixate the patient's foot against your body.
- **Movement grip:** With your right hand, grip around the patient's cuneiform bone just distal to the joint space.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted joint is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With distal movement of the cuneiform bone, gently tighten joint slack through the Transition Zone, following the line of drive through the long axis of the forefoot. Without pause, apply a distal thrust the instant you sense marked resistance to the passive tightening movement.
- **Reassess** key signs.

■ Figure 10b - Cuneonavicular joint with wedge fixation

- **Fixation grip:** Place the plantar side of the patient's foot on a treatment wedge, with the targeted joint outside the wedge. Fixate with your left hand just proximal to the targeted joint space.

■ (Not shown) - Talonavicular and 1st cuneiform-1st metatarsal joints

- Modify your grip to treat the talonavicular joint and the joint between the 1st cuneiform and 1st metatarsal.

Foot joints on the lateral side

traction-manipulation



Figure 11a - metatarsals IV/V-cuboid with fixation against the body



Figure 11b - metatarsals IV/V-cuboid with fixation on a wedge

■ Figure 11a - Metatarsals IV/V-cuboid with body fixation

Set up

- **Patient position:** Supine with the foot in the Actual Resting Position.
- **Fixation grip:** With your right hand, grip the patient's foot and cuboid bone from the lateral side just proximal to the joint space. Fixate the patient's foot against your body.
- **Movement grip:** With your left hand, grip the patient's 4th and 5th metatarsals just distal to the joint space.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted joint is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With distal movement of the 4th and 5th metatarsal bones, gently tighten joint slack through the Transition Zone, following the line of drive through the long axis of the metatarsals. Without pause, apply a distal thrust the instant you sense marked resistance to the passive tightening movement.
- **Reassess** key signs.

■ Figure 11b - Metatarsals IV/V-cuboid with wedge fixation

- **Fixation grip:** Place the plantar side of the patient's foot on a treatment wedge with the 4th and 5th metatarsals outside the wedge. Fixate the cuboid bone against the treatment wedge with your right hand.

■ (Not shown) Calcaneocuboid and cuboid-3rd cuneiform/navicular joints

- Modify your grip to treat the calcaneocuboid joint and the joint between the cuboid and 3rd cuneiform/navicular bones.

Posterior talocalcaneal (subtalar) joint *traction-manipulation*



Figure 12a
with finger grip



Figure 12b
with thenar grip

■ Figure 12a - With fingers for the movement grip

Set up

- **Patient position:** Prone with the foot in the Actual Resting Position.
- **Fixation grip:** With your left hand, grip the patient's talus and lower leg from the anterior side. Fixate the talus against the treatment surface. Place your palpating finger in the joint space.
- **Movement grip:** With your right thumb and fingers, grip around the patient's calcaneus. Align your forearm parallel to the line of drive along the long axis of the leg.

Procedure.

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted joint is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With distal movement of the calcaneus, gently tighten joint slack through the Transition Zone, following the line of drive at a right angle to the Treatment Plane. Without pause, apply a distal thrust the instant you sense marked resistance to the passive tightening movement.
- Reassess key signs.

■ Figure 12b - With thenar eminence and fingers for the movement grip

- **Movement grip:** With your right thenar eminence and fingers, grip around the patient's calcaneus.

Talocrural joint

traction-manipulation



Figure 13a
with palpation and one-hand grip



Figure 13b
with two-hand grip

■ Figure 13a - With one-hand movement grip

Set up

- **Patient position:** Supine with the ankle in the Actual Resting Position.
- **Fixation grip:** Fixate the distal leg against the treatment table with a strap. With your left hand, grip around the patient's lower leg to reinforce the fixation. Place your palpating finger in the joint space.
- **Movement grip:** With your right hand, grip around the patient's midfoot from the tibial side with your little finger over the dorsal talus. Align your forearm parallel to the line of drive along the long axis of the leg.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted joint is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With distal movement of the talus, gently tighten joint slack through the Transition Zone, following the line of drive through the long axis of the leg. Without pause, apply a distal thrust the instant you sense marked resistance to the passive tightening movement.
- **Reassess** key signs.

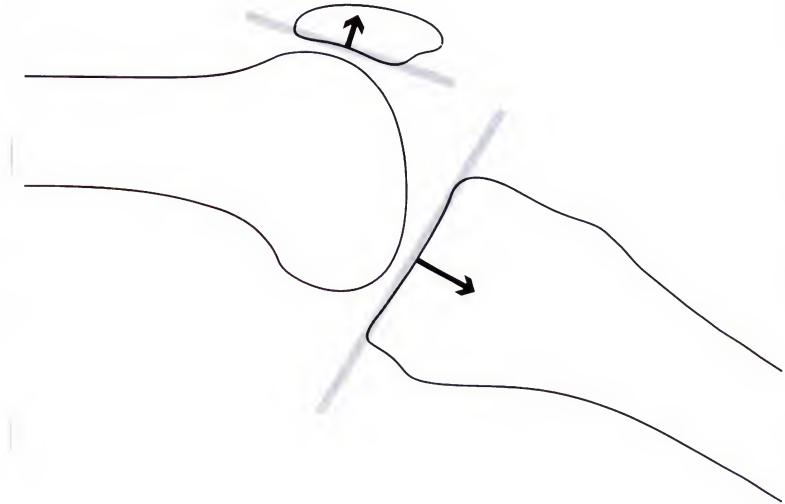
■ Figure 13b - With two-hand movement grip

- **Movement grip:** With your left hand, grip around your right hand to supplement the grip.
- **Traction-manipulation:** Apply traction-manipulation to the talus following the line of drive through the long axis of the leg. Shift your body weight backward to gently tighten the joint slack through the Transition Zone. Without pause, apply a distal thrust with both arms.

■ **Notes**

Knee

Tibiofemoral (genual) joint and patellofemoral joint



Normal Resting Position

- *Tibiofemoral joint*: Approximately 25° - 40° flexion.
- *Patellofemoral joint*: Knee extension.

Actual Resting Position

- May be quite different from the Normal Resting Position in the presence of pathology.

Line of drive for traction-manipulation

- *Tibiofemoral joint*: The line of drive lies at a right angle to the Treatment Plane on the concave joint surface of the tibia, along the long axis of the bone. When manipulation techniques are applied with proximal fixation, the femur remains fixed and the *orientation of the line of drive changes* to follow position changes of the tibia.

Knee joint

traction-manipulation



Figure 14a
with hand fixation on a table



Figure 14b
with strap fixation on a table

■ Figure 14a - With hand fixation

Set up

- **Patient position:** Prone with the knee in the Actual Resting Position.
- **Fixation grip:** With your right hand, grip around the posterior side of the patient's distal thigh and fixate it against the treatment table. Place your palpating finger in the joint space.
- **Movement grip:** With your left hand, grip around the anterior side of the patient's leg above the ankle. Align your forearm with the line of drive through the long axis of the leg.

Procedure

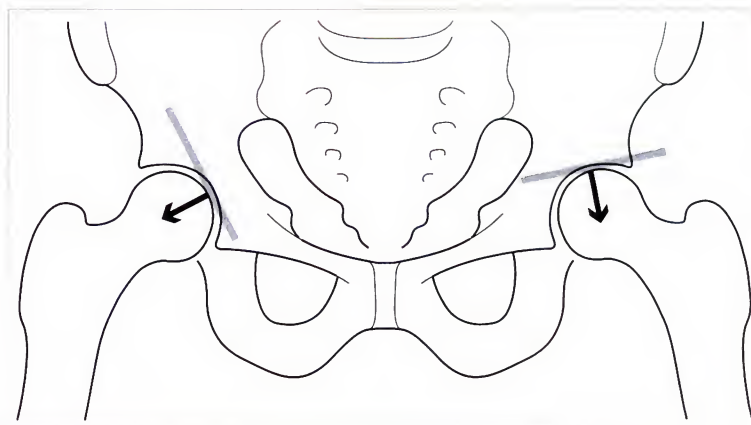
- Apply joint play tests and relaxation techniques as necessary to insure that the targeted joint is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With distal movement of the leg, gently tighten joint slack through the Transition Zone, following the line of drive through the long axis of the leg. Without pause, apply a distal thrust the instant you sense marked resistance to the passive tightening movement.
- **Reassess** key signs.

■ Figure 14b - With strap fixation

- **Fixation:** Fixate the patient's distal thigh against the treatment table with a strap.
- **Movement grip:** With both hands, grip around the patient's lower leg above the ankle joint.
- **Traction-manipulation:** Apply traction-manipulation to the tibia following the line of drive through the long axis of the leg. Shift your body weight backward to tighten the joint slack. Apply a distal thrust with both arms.

Hip

Coxal joint



Normal Resting Position

- Approximately 30° hip flexion, 30° hip abduction, and slight external rotation.

Actual Resting Position

- May be quite different from the Normal Resting Position in the presence of pathology.

Treatment Plane

- A hip joint may present with two or more Treatment Planes, depending on the curvature of the femoral head and acetabulum.

Line of drive for traction-manipulation

- *Lateral traction*: The line of drive lies at a right angle to the Treatment Plane on the concave joint surface of the acetabulum, and the *orientation of the line of drive remains fixed* as the position of the femur changes.
- *Distal traction*: Theoretically, the line of drive remains fixed as the position of the femur changes, since the Treatment Plane lies on the concave surface of the acetabulum. However, since there are multiple Treatment Planes on the acetabular surface, *in fact the orientation of the line of drive changes* as the position of the femur changes, and closely follows the longitudinal axis of the femur.

Hip joint

traction-manipulation with distal thrust



Figure 15a
with two-hand grip on the thigh



Figure 15b
with two-hand grip on the leg

■ Figure 15a - With movement grip on the thigh

Set up

- **Patient position:** Supine with the hip in the Actual Resting Position. Position the lumbar spine in slight right sidebending to minimize left lumbar sidebending during the maneuver.
- **Fixation:** Use a pommel (shown) or stirrup around the right ischial tuberosity to prevent caudal movement of the right innominate. If a stirrup is used, it should be attached to the treatment table cranially to the patient's shoulder. Use a strap around the pelvis just below the anterior superior iliac spine to prevent side-bending of the spine.
- **Movement grip:** Grip around the patient's distal thigh with both hands.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted joint is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** Shift your body backward to move the thigh distally and gently tighten joint slack through the Transition Zone, following the line of drive through the long axis of the thigh. Without pause, apply a distal thrust with your arms the instant you sense marked resistance to the passive tightening movement.
- **Reassess** key signs.

Figure 15b - With movement grip on the leg

- **Movement grip:** Use both hands to grip around the patient's lower leg above the ankle joint.
- **Note:** This technique positions the knee in a close-packed position with knee extension and should only be used on patients without knee problems.

Hip joint

traction-manipulation with lateral thrust



Figure 16a
with two-hand grip on the thigh



Figure 16b
with two-hand grip and strap on the thigh

■ Figure 16a - With movement grip on the thigh

Set up

- **Patient position:** Supine with the hip in the Actual Resting Position.
- **Fixation:** Use a strap around and under the patient's pelvis and attach it to the opposite side of the treatment table to stabilize the pelvis.
- **Movement grip:** Grip around the patient's proximal thigh with both hands.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted joint is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With a lateral and slightly distal movement of the thigh, gently tighten joint slack through the Transition Zone, following the line of drive through the long axis of the femoral neck. Without pause, apply a lateral thrust the instant you sense marked resistance to the passive tightening movement.
- **Reassess** key signs.

■ Figure 16b - With movement grip on the thigh with strap

- **Movement grip:** Fasten a strap around the patient's proximal thigh and around your body, with your hands underneath the strap to help control the hip's Actual Resting Position.
- **Traction-manipulation:** Gently lean backward in the direction of the line of drive and tighten the joint slack. Apply the lateral thrust using your arms (not your body).

How to find the Actual Resting Position in the spine

■ Example: Cervical

- 1) Begin your exploration of the Actual Resting Position by positioning the joint in a typical resting position according to established norms (e.g., the Normal Resting Position for the neck is slight lordosis). If you observe that the patient presents with an atypical resting position (e.g., holding the neck in marked sidebending), then begin your exploration there.
- 2) In this approximate resting position, apply several gentle Grade II traction joint play tests to the first stop, feeling for the ease and degree of movement.
- 3) Re-position into slightly more or less flexion or extension and apply the traction tests again until you locate the position with the greatest ease and degree of movement. Maintain this position as you proceed to the next step.
- 4) Repeat the traction tests with subtle repositioning into more or less sidebending and apply the traction tests again until you locate the position with greatest ease and degree of movement. Maintain this flexion/extension and sidebending position as you proceed to the next step.
- 5) Repeat the traction tests with subtle repositioning into more or less rotation until you find the position with the greatest ease and range of movement in all three dimensions.

This is the *Actual Resting Position* for this patient, at this moment in time.

■ Comments

- The Actual Resting Position may vary considerably from the Normal Resting Position due to pathological changes and as a response to therapeutic intervention.
- Experienced practitioners speed their exploration of the Actual Resting Position with simultaneous joint re-positioning in multiple planes.
- Extraarticular soft tissue shortening may require positioning a spinal region (i.e., multiple spinal joints) outside the Normal Resting Position in order to position the joint you wish to manipulate in its resting (i.e., most loose) position.
- The direction of the final traction test (see #5 above) establishes the orientation of the line of drive for traction-manipulation. The Treatment Plane lies at a right angle to it.

Upper cervical spine

Occiput-atlas and atlas-axis

Normal Resting Position

- Slight lordosis.

Actual Resting Position

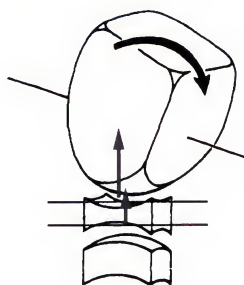
- The Actual Resting Position may be quite different from the Normal Resting Position in the presence of pathology.

There is so little movement range in the upper cervical spine that even very small deviations from the resting position can lock the upper cervical joints, so neither mobilization nor manipulation can occur. In the presence of a joint restriction or pathology, joint locking can occur with even the slightest deviation from the Actual Resting Position. This is one of the reasons specific upper cervical manipulation is so difficult for novice practitioners.

Line of drive for traction-manipulation

- *Occiput-atlas (OA) joints*: The line of drive lies at a right angle to the Treatment Plane on the cranial concave joint surface of the atlas. The *orientation of the line of drive remains unchanged* with any change in the position of the occiput (Convex Rule).
- *Atlas-axis (AA) joints*: The line of drive lies at a right angle to the Treatment Plane on the caudal concave surface of the atlas. When the position of the atlas changes, the *orientation of the line of drive changes* to follow it (Concave Rule). In flexion/extension the atlas moves and the line of drive changes to follow it. In rotation around the longitudinal axis the orientation of the line of drive remains relatively unchanged.

Figure UC-1
The line of drive for the
occiput-atlas and atlas-axis
joints



Atlas-axis *instability test in supine with fixation*



Figure 17
atlas-axis test

■ Figure 17 - Atlas-axis joints

Objective

- **Test for instability:** There should be no lateral movement between the atlas and axis. If lateral movement is present, there may be dangerous insufficiency of the transverse or alar ligaments, or fracture. In this case mobilization and manipulation are strictly contraindicated, and the patient should be referred immediately for further medical examination.

Set up

- **Patient position:** Supine with the neck in the Actual Resting Position.
- **Fixation grip:** With the radial side of your right index finger, fixate the right arch of the axis just dorsal to the transverse process. Stabilize the head with the palm of your right hand, being careful to avoid sidebending of the head.
- **Movement grip:** Place your left index finger on the left arch of the atlas just dorsal to the transverse process. Avoid pressure directly on the sensitive transverse process.

Procedure

- Test joint play gliding, endfeel, and mobility by applying slow medial pressure to the atlas.
- Test in both directions.

■ (Not shown) - Atlas-axis joints alternative technique

- **Test for instability:** Relocate your hand placement to fixate the occiput and atlas and test for lateral movement with the axis.

Occiput-atlas and atlas-axis joints

traction-manipulation in supine without fixation



Figure 18a
occiput-atlas joints

■ Figure 18a - Occiput-atlas joints

Set up

- **Patient position:** Supine with the neck in the Actual Resting Position.
- **Movement grip:** Grasp the dorsal and lateral aspect of the patient's occiput with your index or middle fingers under the occiput and your hands cupped around the patient's head. Take care not to squeeze the patient's ears.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** First lean backward with your body to gently tighten the slack through the Transition Zone, following the line of drive in the cranial direction. Without pause, apply a cranial thrust the instant you sense marked resistance to the passive tightening movement. For speed, thrust using your arms, not your body.

Since this technique has no fixation, the thrust must be extremely quick to produce a local effect. Slower movements may only affect lower segments.

- **Reassess** key signs.

■ (Not shown) - Atlas-axis joints

- Relocate your hand contact to grip the atlas. The line of drive runs at a right angle to the Treatment Plane on the atlas.

Occiput-atlas and atlas-axis joints

traction-manipulation in supine

without fixation



Figure 18b
occiput-atlas

■ Figure 18b - Occiput-atlas joints

Set up

- **Patient position:** Supine with the neck in the Actual Resting Position. In order to improve contact to the mastoid process, position the patient's lower cervical spine into slight left rotation, taking care to preserve the Actual Resting Position of the occiput-atlas joint.
- **Movement grip:** With your left hand and arm, lift the patient's head slightly from the table, your hand gently cupping the patient's chin and your arm cradled around the head. With your right hand and arm, place the radial side of your index finger under the right mastoid process and align your forearm in the line of drive pointing cranially.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With cranial movement of your arms, gently tighten joint slack through the Transition Zone, following the line of drive in a cranial direction. Without pause, apply a cranial thrust through the mastoid the instant you sense marked resistance to the passive tightening movement. The thrust is applied primarily with your right hand and arm; your left arm and body maintain joint tightening.

Since this technique has no fixation, the thrust must be extremely quick to produce a local effect. Slower movements may only affect lower segments.

- Reassess key signs.

■ (Not shown) - Atlas-axis joints

- Relocate your grips for the atlas-axis joint. The line of drive runs at a right angle to the Treatment Plane on the atlas.

Occiput-atlas and atlas-axis joints

traction-manipulation in sitting

without fixation



Figure 19a
occiput-atlas

■ Figure 19a - Occiput-atlas joints

Set up

- **Patient position:** Sitting with the neck in the Actual Resting Position.
- **Movement grip:** Place your palms under the mastoid processes of the patient's occiput. Place your forearms on top of the patient's shoulders.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** Pivot your forearms over the fulcrum provided by the patient's shoulders to gently tighten joint slack in the OA joints through the Transition Zone, following the line of drive in a cranial direction. Without pause, apply a cranial thrust through the mastoid the instant you sense marked resistance to the passive tightening movement. The thrust is applied with your hands; your body contact through the shoulders maintains joint tightening.

Since this technique has no fixation, the thrust must be extremely quick to produce a local effect. Slower movements may only affect lower segments.

- **Reassess** key signs.

■ (Not shown) - Atlas-axis joints

- Relocate your grips for the atlas-axis joints. The line of drive runs at a right angle to the Treatment Plane on the atlas.

Occiput-atlas and atlas-axis joints

traction-manipulation in sitting

with fixation



Figure 19b
occiput-atlas

■ Figure 19b - Occiput-atlas joints

Set up

- **Patient position:** Sitting with the neck in the Actual Resting Position.
- **Fixation grip:** With your left hand, grasp around the patient's atlas from the dorsal side to fixate the atlas in a caudal direction. Use the remaining part of your hand to fixate the spine caudal to the atlas.
- **Movement grip:** With your right hand, lightly hold the patient's head against your chest, cupping your little finger under the patient's occiput.
Take care that your body contact with the patient's head does not alter the patient's Actual Resting Position.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With a cranial movement, gently tighten joint slack through the Transition Zone, following the line of drive in a cranial direction. Without pause, apply a cranial thrust through the occiput the instant you sense marked resistance to the passive tightening movement. The thrust is applied with your right hand and arm; your body and left hand maintain joint tightening and fixation.
- **Reassess** key signs.

■ (Not shown) - Atlas-axis joints

- Relocate your grip for the atlas-axis joint. The line of drive runs at a right angle to the Treatment Plane on the atlas.

Occiput-atlas joint *traction-manipulation in sitting with fixation*



Figure 19c

■ Figure 19c

Set up

- **Patient position:** Sitting with the neck in the Actual Resting Position.
- **Fixation grip:** With your right thumb supported by your index finger, fixate the right transverse process of the patient's atlas. You may need to reinforce your fixation grip with your left hand.
- **Movement grip:** With your left arm and chest, cradle around the patient's head with your proximal forearm under the patient's chin.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With cranial movement of your left arm, gently tighten joint slack through the Transition Zone, following the line of drive in a cranial direction. Without pause, apply a cranial thrust through the head the instant you sense marked resistance to the passive tightening movement. Thrust with your left arm; your right arm and body maintain joint tightening. You may need to increase contact pressure to the transverse process of the atlas at the moment of the thrust to preserve adequate fixation.

While this is a very effective traction-manipulation technique for the occiput-atlas joint, it unfortunately is also one of the most difficult to do. Only the most skilled manipulative practitioners are successful with it. That said, the technique can still be safely used for practice by novices.

* This technique is originally credited to Cramer (1955). Kaltenborn modified the technique and replaced Cramer's rotation component with a traction component.

Cervical spine C2 - T3

From a functional perspective, the cervical spine includes C2 - T3.

Normal Resting Position

- Slight lordosis.

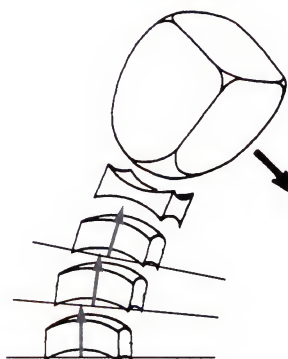
Actual Resting Position

- May be quite different from the Normal Resting Position in the presence of pathology. Take care to maintain the patient's Actual Resting Position in the supine position, as the patient's head will have a tendency to fall backward into excessive lordosis.

Line of drive for traction-manipulation

- *C2 - T3 intervertebral joints*: The line of drive lies at a right angle to the Treatment Plane on the caudal joint surface of the cranial joint partner. The *line of drive changes* its orientation to follow changes in the position of the cranial joint partner.

Figure C-1
C2 - T3 LINE OF DRIVE
The line of drive changes its orientation (red arrows) with any change in the position of the cranial joint partner.



Cervical spine C2 - C6

traction-manipulation

in sidelying with fixation and in supine without fixation



Figure 20a
with fixation



Figure 20b
without fixation

■ Figure 20a - sidelying with fixation

Set up

- **Patient position:** Sidelying with the neck in the Actual Resting Position.
- **Fixation grip:** With your left fingers and hand, fixate the caudal joint partner. Stabilize the patient's body with your arm and chest.
- **Movement grip:** With your right forearm and hand, cradle around the patient's head and neck, with your little finger cupping under the spinous process of the cranial joint partner.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With cranial movement, gently tighten joint slack through the Transition Zone, following the line of drive through the long axis of the neck. Without pause, apply a cranial thrust through the cranial joint partner the instant you sense marked resistance to the passive tightening movement. The thrust is applied with your right hand and arm; your body and left arm maintain joint tightening and fixation.
- **Reassess** key signs.

■ Figure 20b - supine without fixation

- Actual Resting Position in supine. Apply a cranial thrust with your hands and index fingers on the cranial joint partner.

Since this technique has no fixation, the thrust must be extremely quick to produce a local effect. Slower movements may only affect lower segments.

Cervical spine C2 - C6

traction-manipulation in supine in antalgic positions without fixation



Figure 21a
in sidebending



Figure 21b
in sidebending with rotation

■ Figure 21a - in sidebending

Set up

- **Patient position:** Supine. The Actual Resting Position of the neck is in sidebending.
- **Movement grip:** Place your hands around the patient's neck, with your index fingers on the cranial joint partner. You may reinforce your grip with a strap around your body and over your hands.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** First lean back with your body to gently tighten joint slack through the Transition Zone, following the line of drive in a cranial direction through the long axis of the neck (Concave Rule) in its antalgic position. Without pause, apply a cranial thrust through the cranial joint partner the instant you sense marked resistance to the passive tightening movement. The thrust is applied with your arms; your body (and strap) maintain joint tightening.

Since this technique has no fixation, the thrust must be extremely quick to produce a local effect. Slower movements may only affect lower segments.

The direction of thrust is dictated by the position of the neck. The line of drive is an elongation of the neck position, not an elongation of the patient's body position.

- **Reassess** key signs.

■ Figure 21b - in sidebending/rotation

- The Actual Resting Position of the neck is in sidebending and rotation.

Cervical spine C2 - C6

traction-manipulation in supine with unilateral contact without fixation



Figure 22a

■ Figure 22a

Set up

- **Patient position:** Supine with the neck in the Actual Resting Position.
- **Movement grip:** With your left hand and arm, lift the patient's head slightly from the table, your hand gently cupping the patient's chin and your arm cradled around their head. The radial aspect of your right index finger contacts the right lateral/dorsal aspect of the arch (articular process) of the cranial joint partner. Avoid contact to the sensitive transverse process. Align your forearm in the line of drive pointing cranially.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With a cranial movement of your body and left arm, gently tighten joint slack through the Transition Zone, following the line of drive through the long axis of the neck at a right angle to the Treatment Plane of the cranial joint partner. Without pause, apply a cranial thrust through the cranial joint partner the instant you sense marked resistance to the passive tightening movement. The thrust is applied primarily with your right arm; your left arm and body maintain joint tightening.

Since this technique has no fixation, the thrust must be extremely quick to produce a local effect. Slower movements may only affect lower segments.

- Some practitioners believe this technique primarily affects the facet joint, however, the technique can act on the entire segment.
- **Reassess** key signs.

Cervical spine C2 - C6

traction-manipulation in sitting with fixation



Figure 22b

■ Figure 22b

Set up

- **Patient position:** Sitting with the neck in the Actual Resting Position.
- **Fixation grip:** With your right hand, grasp around the patient's caudal joint partner from the dorsal side and fixate it in a caudal direction. Use the remaining part of your hand to fixate the spine caudal to the segment.
- **Movement grip:** With your left hand, lightly hold the patient's head against your chest and your little finger against the cranial joint partner.

Take care that your body contact with the patient's head does not alter the patient's Actual Resting Position.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With a cranial movement, gently tighten joint slack through the Transition Zone, following the line of drive through the long axis of the neck at a right angle to the Treatment Plane of the cranial joint partner. Without pause, apply a cranial thrust the instant you sense marked resistance to the passive tightening movement. The thrust is applied with your left hand and arm; your body and right hand maintain joint tightening and fixation.
- **Reassess** key signs.

Cervicothoracic spine C7 - T3

traction-manipulation in sidelying with fixation



Figure 23a

■ Figure 23a

Set up

- **Patient position:** Sidelying with the neck in the Actual Resting Position.
- **Fixation grip:** With the fingers of your right hand, fixate the caudal joint partner. Stabilize the patient's body with your arm and chest.
- **Movement grip:** With your left forearm and hand, cradle around the patient's head and neck with your little finger cupping under the spinous process of the cranial joint partner.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With cranial movement of your left arm, gently tighten joint slack through the Transition Zone, following the line of drive through the long axis of the neck. Without pause, apply a cranial thrust through the cranial joint partner the instant you sense marked resistance to the passive tightening movement. The thrust is applied with your left hand and arm; your body and right arm maintain joint tightening and fixation.
- **Reassess** key signs.

Cervicothoracic spine C7 - T3

traction-manipulation in supine with wedge fixation



Figure 23b

■ Figure 23b

Set up

- **Patient position:** Supine with the neck in the Actual Resting Position. The patient's arms are folded either behind the neck or across the chest.
- **Fixation:** Position a wedge pointing caudally, with its peaks on the transverse processes of the caudal joint partner.
- **Movement grip:** With your right hand, grip the patient's elbows from the caudal side, with your forearm aligned in the line of drive. With your left arm and hand, cradle the patient's head and neck with your palpating finger between the peaks of the wedge in the interspinous space at the targeted segment.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With cranial movement of the patient's arms and shoulder girdle, gently tighten joint slack through the Transition Zone, following the line of drive at a right angle to the Treatment Plane of the cranial joint partner. Without pause, apply a cranial thrust through the patient's arms and shoulder girdle the instant you sense marked resistance to the passive tightening movement. The thrust is applied with your right arm; your body and left arm maintain joint tightening.
- **Reassess** key signs.

Cervicothoracic spine C7 - T3

traction-manipulation in sitting

without fixation



Figure 24a

■ Figure 24a

Set up

- **Patient position:** Sitting or standing with the neck in the Actual Resting Position. The patient's hands are folded behind the neck. If the patient is unable to reach this position, they can position their hands at the limit of their reach.
- **Movement grip:** With both your hands under the patient's shoulders, cup your index fingers one upon the other under the spinous process of the cranial joint partner. Place your other fingers over the patient's hands. Keep your forearms close to the patient's body.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** Shift backward with your body until the line of drive is at a right angle to the Treatment Plane of the cranial joint partner. Allow the patient's body to relax below your hand/body contact. This gently tightens joint slack through the Transition Zone.

Without pause, apply a cranial thrust through the cranial joint partner the instant you sense marked resistance to the passive tightening movement. The thrust is applied with your hands and arms. Your body has no contact with the patient's body below the targeted segment. Joint tightening is maintained throughout the maneuver by the patient's body weight.

Since this technique has no fixation, the thrust must be extremely quick to produce a local effect. Slower movements may only affect lower segments.

- **Note:** Some practitioners have difficulty with this technique due to limitations in flexibility and limb length, and must take care to adapt their grip so as not to force the patient's neck into excessive flexion nor pull the patient's shoulders into an extreme position.
- **Reassess** key signs.

Cervicothoracic spine C7 - T3

traction-manipulation in sitting

with fixation



Figure 24b

■ Figure 24b

Set up

- **Patient position:** Sitting with the neck in the Actual Resting Position.
- **Fixation grip:** With your left hand, grasp around the patient's left shoulder girdle from the cranial/dorsal side. Fixate in a caudal direction with your thumb on the spinous process of the caudal joint partner.
- **Movement grip:** With your right hand, lightly hold the patient's head against your chest with your little finger cupped under the cranial joint partner.

Take care that your body contact with the patient's head does not alter the patient's Actual Resting Position.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With a cranial movement of your right arm and your body, gently tighten joint slack through the Transition Zone, following the line of drive at a right angle to the Treatment Plane of the cranial joint partner. Without pause, apply a cranial thrust the instant you sense marked resistance to the passive tightening movement. The thrust is applied with your right hand; your body and left hand maintain joint tightening and fixation.
- **Reassess** key signs.

■ Notes

Thoracic spine and ribs

Normal Resting Position

- Slight kyphosis.

Actual Resting Position

- May be quite different from the Normal Resting Position in the presence of pathology. To preserve the Actual Resting Position of the thoracic spine in prone techniques (e.g., massage or posterior-anterior mobilizations) use a pillow under the patient's thorax to support the kyphosis.

Line of drive for traction-manipulation

- The line of drive lies at a right angle to the Treatment Plane on the concave caudal joint surface of the cranial joint partner. The *line of drive changes* its orientation with any change in cranial joint partner position.

Thoracic spine T4-T12

traction-manipulation in sidelying with fixation



Figure 25a

■ Figure 25a

Set up

- **Patient position:** Sidelying with the thoracic spine in the Actual Resting Position. The patient's arms are folded with hands on opposite shoulders.
- **Fixation grip:** With the fingers of your right hand, fixate the caudal joint partner. Stabilize the patient's body with your arm and chest.
- **Movement grip:** With your left forearm and hand, cradle around the patient's head, neck, and shoulder girdle. Cup your fingers under the spinous process of the cranial joint partner.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With cranial movement of your left arm, gently tighten joint slack through the Transition Zone, following the line of drive at a right angle to the Treatment Plane of the cranial joint partner. Without pause, apply a cranial thrust the instant you sense marked resistance to the passive tightening movement. The thrust is applied with your left hand and arm; your body, right arm and fingers maintain joint tightening and fixation.
- **Reassess** key signs.

Thoracic spine T4-T12

traction-manipulation in supine with wedge fixation



Figure 25b

■ Figure 25b

Set up

- **Patient position:** Supine with the thoracic spine in the Actual Resting Position. The patient's arms are folded across the chest with hands on opposite shoulders.
- **Fixation:** Position a wedge pointing caudally, with its peaks on the transverse processes of the caudal joint partner.
- **Movement grip:** With your right hand, grip the patient's elbows from the caudal side with your forearm aligned in the line of drive. With your left arm and hand cradle the patient's head, neck, and upper thoracic spine with your palpating finger between the peaks of the wedge in the interspinous space at the targeted segment.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With cranial movement of the patient's arms and shoulder girdle, gently tighten joint slack through the Transition Zone, following the line of drive at a right angle to the Treatment Plane of the cranial joint partner. Without pause, apply a cranial thrust through the patient's arms and shoulder girdle the instant you sense marked resistance to the passive tightening movement. The thrust is applied with your right arm; your body and left arm maintain joint tightening.
- **Reassess** key signs.

Thoracic spine T4-T12

traction-manipulation in sitting

using a wedge grip without fixation



Figure 26a

■ Figure 26a

Set up

- **Patient position:** Sitting (as shown) or standing with the thoracic spine in the Actual Resting Position. The patient's arms are folded across the chest with hands on opposite shoulders.
- **Movement grip:** Use a wedge to create a contact point between you and the cranial joint partner. The wedge points cranially, its peaks in contact with the transverse processes of the cranial joint partner. There is no contact between you and the patient below the wedge. Grip the patient's elbows with both hands.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** Shift slowly backward with your body until the line of drive is at a right angle to the Treatment Plane of the cranial joint partner. Allow the patient's body to relax below the wedge. This gently tightens joint slack through the Transition Zone.

Without pause, apply a cranial thrust through the patient's elbows and shoulder-girdle the instant you sense marked resistance to the passive tightening movement in the shoulder girdle and spine. Apply the thrust with your arms and body. Joint tightening is maintained throughout the maneuver with the lifting force.

Since this technique has no fixation, the thrust must be extremely quick to produce a local effect. Slower movements may only affect lower segments.

- **Reassess** key signs.

Thoracic spine T4-T12

traction-manipulation in sitting

with wedge fixation



Figure 26b

■ Figure 26b

Set up

- **Patient position:** Sitting (as shown) or standing with the thoracic spine in the Actual Resting Position. The patient's arms are folded across the chest with hands on opposite shoulders.
- **Fixation grip:** Use a wedge to create a contact point between you and the caudal joint partner. The wedge points caudally, with its peaks on the transverse processes of the caudal joint partner.
- **Movement grip:** Grip the patient's elbows with both hands.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** Shift slowly backward with your body until the line of drive is at a right angle to the Treatment Plane of the cranial joint partner. This gently tightens joint slack through the Transition Zone.
Without pause, apply a cranial thrust through the patient's elbows and shoulder-girdle the instant you sense marked resistance to the passive tightening movement in the shoulder girdle and spine. Apply the thrust with your arms only, while your body maintains stable contact with the wedge to fixate the caudal vertebra. Joint tightening is maintained throughout the maneuver with the lifting force.
- **Reassess** key signs.

First rib

traction-manipulation in sitting and supine with fixation



Figure 27a
with arm fixation



Figure 27b
with hand fixation

■ Figure 27a - with arm fixation

Set up

- **Patient position:** Sitting with the neck and upper thoracic spine in the Actual Resting Position.
- **Fixation grip:** Place your left upper arm and elbow over the patient's left shoulder. Cradle the head and neck against your chest with your forearm and hand. Rotate the head and cervical spine (including T1) to the right. This prevents left rotation of the T1 segment during the procedure.
- **Movement grip:** Place the radial side of your right index finger on the dorsal aspect of the patient's first rib. Align your forearm in the line of drive at a right angle to the Treatment Plane.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted joint is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With your right arm, gently tighten joint slack through the Transition Zone, following the line of drive in a ventral and slightly caudal direction. Without pause, apply a ventral and slightly caudal thrust the instant you sense marked resistance to the passive tightening movement.
- *With a cranially fixated first rib, the line of drive is in a caudal direction.*
- **Reassess** key signs.

■ Figure 27b - with hand fixation

- The patient lies supine. Your left hand rotates the lower cervical vertebrae (including T1) from the dorsal side and fixates these segments to the right.

2nd - 12th ribs

traction-manipulation in sitting with rib thrust



Figure 28a

■ Figure 28a

Set up

- **Patient position:** Sitting with the thorax in the Actual Resting Position. The patient's arms are folded across the chest.
- **Fixation grip:** Cradle the patient's upper body against your chest with your left hand and arm. Rotate the patient's thoracic spine to the right until rotation occurs in the articulating vertebra of the targeted rib. This stabilizes the articulating vertebra and prevents it from rotating to the left during the procedure.
- **Movement grip:** Place the radial side of your right index finger on the rib with your MCP joint just lateral to the transverse process of the articulating vertebra. If desired, use your right thumb to reinforce the contact. Align your forearm in the line of drive.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted joint is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With your right arm, gently tighten joint slack through the Transition Zone, following the line of drive. The line of drive is ventral and slightly caudal for the upper ribs, ventral for the middle ribs, and ventral and slightly cranial for the lower ribs. Without pause, apply a thrust the instant you sense marked resistance to the passive tightening movement – and at the moment of the patient's *maximum* exhalation.
- **Reassess** key signs.

2nd - 12th ribs

traction-manipulation in supine with rib fixation



Figure 28b

■ Figure 28b

Set up

- **Patient position:** Supine with the thorax in the Actual Resting Position. The patient's arms are folded across the chest with hands on opposite shoulders and their head lifted. The patient's head position can also be supported by a pillow or your right arm with an alternate grip.
- **Fixation grip:** Place your left thenar eminence with an adducted thumb, underneath the right rib to be treated. The tip of your thumb is just lateral to the transverse process of the articulating vertebra.
- **Movement grip:** Place your right forearm over the patient's crossed arms with your chest in contact with the patient's elbows and your right hand holding the patient's right arm.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted joint is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** To tighten the joint slack through the Transition Zone, first gently roll the patient to the right over your thumb fixation. Then, as the patient exhales, gently lean on the patient's arms with your chest. Without pause, the instant you sense marked resistance to the passive tightening movement – and at the moment of the patient's *maximum* exhalation – apply a thrust through the patient's folded arms and chest in a dorsal and slightly lateral direction.
- **Reassess** key signs.

Lumbar spine

Normal Resting Position

- Slight lordosis.

Actual Resting Position

- May be quite different from the Normal Resting Position in the presence of pathology. To preserve the Actual Resting Position of the lumbar spine in prone techniques (e.g., massage or posterior-anterior mobilizations) use a pillow under the patient's abdomen to prevent excessive lordosis. A pillow under the abdomen is almost always necessary, even for overweight and obese individuals.

Line of drive for traction-manipulation

- The line of drive lies at a right angle to the Treatment Plane on the caudal concave joint surfaces of the fixated cranial vertebrae. The *line of drive remains unchanged* with any change in the orientation of the caudal joint partner position.

Lumbar spine L1 - L5

traction-manipulation in sidelying with fixation



Figure 29

■ Figure 29

Set up

- **Patient position:** Sidelying with the lumbar spine in the Actual Resting Position.
- **Fixation grip:** Place your left forearm and hand over the spine. With your left index and middle fingers, fixate the cranial joint partner. In most cases, the fixation is reinforced by locking segments above the targeted joint in left rotation. The more caudal the segment, the more useful such locking becomes.

With locking techniques, take care to preserve the Actual Resting Position in the targeted segment.

- **Movement grip:** Place your right arm and hand against the sacrum. Place your right index and middle fingers on the caudal joint partner. Position the patient's thighs and anterior pelvis against the right side of your body.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With caudal movement of your right arm and body, gently tighten joint slack through the Transition Zone, following the line of drive at a right angle to the Treatment Plane through the cranial joint partner. Without pause, the instant you sense marked resistance to the passive tightening movement – and at the moment of the patient's maximum exhalation – apply a caudal thrust with your right arm and body. Your left arm must not move during the thrust; it must remain in a stable position to maintain fixation.
- **Reassess** key signs.

Lumbar spine L1 - L5

traction-manipulation in sidelying with head-drop technique and fixation



Figure 30a
with hand grip



Figure 30b
with forearm grip

■ Figure 30a - with hand grip

Set up

- **Patient position:** Sidelying with the lumbar spine in the Actual Resting Position.
- **Fixation grip:** Place your left forearm and hand under the patient's arm and over the spine. With your left index and middle fingers, fixate the cranial joint partner. In most cases, the fixation is reinforced by locking segments above the targeted joint in left rotation.

With locking techniques, take care to preserve the Actual Resting Position in the targeted segment.

- **Movement grip:** Place your right arm and hand against the sacrum. Place your right index and middle fingers on the caudal joint partner. Position the patient's thighs and anterior pelvis against the right side of your body.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With caudal movement of your right arm and body, gently tighten joint slack through the Transition Zone, following the line of drive at a right angle to the Treatment Plane through the cranial joint partner. Without pause, apply a caudal thrust with a "head-drop" maneuver the instant you sense marked resistance to the passive tightening movement and at the moment of the patient's maximum exhalation. Maintain joint tightening and fixation with your arms and body.
- Reassess key signs.

■ Figure 30b - with forearm grip

- For traction-manipulation of L5-S1, use your forearm on the patient's sacrum.

Lumbar spine L1 - L5

traction-manipulation in supine with strap fixation



Figure 31a

■ Figure 31a

Set up

- **Patient position:** Supine with the lumbar spine in the Actual Resting Position.
- **Fixation grip:** Fasten a strap around the patient to stabilize the spine, including the cranial vertebra in the targeted segment.
- **Movement grip:** Grip from behind the patient's legs as close as possible to the popliteal space.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** First lean back slowly with your body to gently tighten joint slack through the Transition Zone, following the line of drive in a caudal direction through the long axis of the trunk (Convex Rule). Without pause, apply a caudal thrust through the patient's legs the instant you sense marked resistance to the passive tightening movement. The thrust is applied with your hands; your body maintains joint tightening.
The direction of thrust is dictated by the position of the trunk. The line of drive is an elongation of the long axis of the trunk, not an elongation of the patient's pelvic or caudal vertebra position.
- **Reassess** key signs.

This is a non-specific technique. It is not possible to localize the thrust to a specific lumbar intervertebral segment, nor to be precisely certain which segments move. Use this technique only when traction tests do not reproduce the patient's symptoms. If traction tests are positive in a neighboring segment, use a specific technique instead.

Lumbar spine L1 - L5

traction-manipulation in supine

using belt or harness with strap fixation



Figure 31b
with a mobilization strap and fixation strap



Figure 31c - with a Morgan harness,
fixation strap, and overhead suspension

■ Figure 31b - with a strap

Set up

- **Patient position:** Supine with the lumbar spine in the Actual Resting Position. If necessary, support the patient's leg position with overhead suspension.
- **Fixation:** Fasten a strap around the patient to stabilize the spine, including the cranial vertebra in the targeted segment.
- **Movement grip:** Fasten a strap around the patient's proximal thighs and around your body. With both hands, grip the strap or grip the patient's pelvis with your hands under the strap. Control the Actual Resting Position with your hands.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction manipulation:** First lean slowly back with your body to gently tighten joint slack through the Transition Zone, following the line of drive in a caudal direction through the long axis of the trunk (Convex Rule). Without pause, apply a caudal thrust through the patient's thighs the instant you sense marked resistance to the passive tightening movement. The thrust is applied with your hands; your body and strap maintain joint tightening.

This is a non-specific technique. It is not possible to localize the thrust to a specific lumbar intervertebral segment, nor to be precisely certain which segments move. Use this technique only when traction tests do not reproduce the patient's symptoms. If traction tests are positive in a neighboring segment, use a specific technique instead.

- Reassess key signs.

■ Figure 31c - with a harness

- Use a traction harness and overhead suspension to control the Actual Resting Position. Lean back to tighten the slack. Apply the thrust with your arms.

Lumbar spine L1 - L5

traction-manipulation sitting

using a wedge grip without fixation

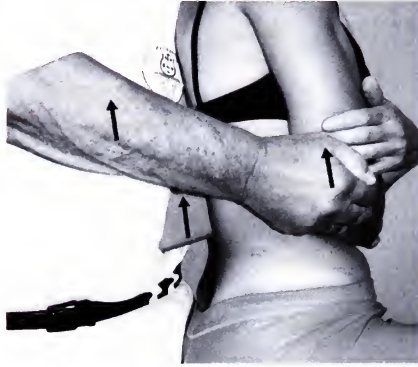


Figure 32a

■ Figure 32a

Set up

- **Patient position:** Sitting (as shown) or standing with the lumbar spine in the Actual Resting Position. The patient's arms are folded across the chest.
- **Movement grip:** Use a wedge to create a contact point between you and the cranial joint partner. The wedge points cranially, its peaks in contact with the transverse processes of the cranial joint partner. There is no contact between you and the patient below the wedge. Grip the patient's elbows with both hands and hold them firmly under the patient's rib cage.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** Shift slowly backward with your body until the line of drive is at a right angle to the Treatment Plane in the cranial joint partner. Allow the patient's body to relax below the wedge. This gently tightens joint slack through the Transition Zone.

Without pause, apply a cranial thrust through the patient's arms and thorax the instant you sense marked resistance to the passive tightening movement. Apply the thrust with your arms. Joint tightening is maintained throughout the maneuver with the lifting force.

Since this technique has no fixation, the thrust must be extremely quick to produce a local effect. Slower movements may only affect lower segments.

- **Reassess** key signs.

Lumbar spine L1 - L5

traction-manipulation in sitting

with wedge fixation

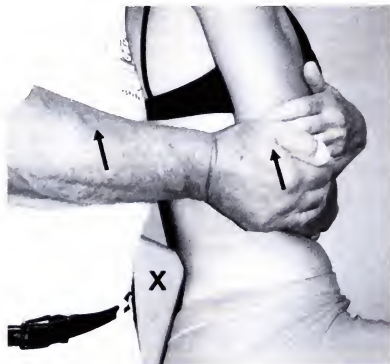


Figure 32b

■ Figure 32b

Set up

- **Patient position:** Sitting (as shown) or standing with the lumbar spine in the Actual Resting Position. The patient's arms are folded across the chest.
- **Fixation grip:** Use a wedge to create a contact point between you and the caudal joint partner. The wedge points caudally with its peaks on the transverse processes of the caudal joint partner.
- **Movement grip:** Grip the patient's elbows with both hands and hold them firmly under the patient's rib cage.

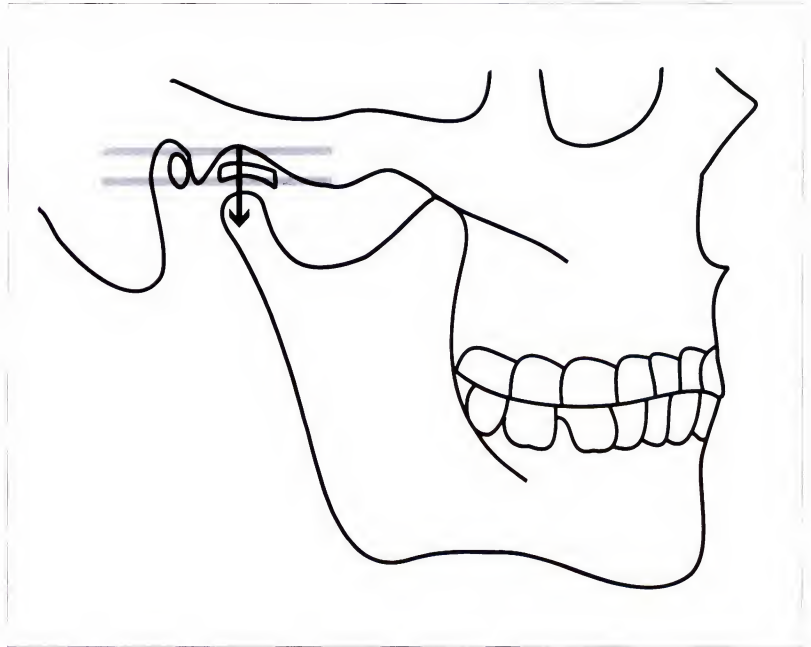
Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted segment is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** Shift slowly backward with your body until the line of drive is at a right angle to the Treatment Plane in the cranial joint partner. This gently tightens joint slack through the Transition Zone. Without pause, apply a cranial thrust through the patient's arms and thorax the instant you sense marked resistance to the passive tightening movement. Apply the thrust with your arms only, while your body maintains stable contact with the wedge to fixate the caudal vertebra or sacrum. Joint tightening is maintained throughout the maneuver with the lifting force.
- **Reassess** key signs.

5

Jaw

Temporomandibular joint (TMJ)



Normal Resting Position

- Mouth slightly open.

Actual Resting Position

- May be different from the Normal Resting Position in the presence of pathology.

Line of drive for traction-manipulation

- The line of drive lies at a right angle to the Treatment Plane on the concave joint surface of the mandibular fossa and its associated articular disc. The *line of drive remains unchanged* with any change in mandibular head position (Convex Rule).

TMJ

traction-manipulation in sitting and supine with fixation



Figure 33a - in sitting



Figure 33b - in supine

■ Figure 33a

Set up

- **Patient position:** Sitting.
- **Fixation grip:** With your right hand, grasp the patient's head and hold it against your body. Palpate the joint space with your index finger or the third finger of your right hand.
- **Movement grip:** With your left thumb, grip the mandible inside the mouth over the posterior, lower molars. Wrap your fingers around the outside of the mandible.

Procedure

- Apply joint play tests and relaxation techniques as necessary to insure that the targeted joint is fully relaxed in the Actual Resting Position.
- **Traction-manipulation:** With caudal movement of the jaw, gently tighten joint slack through the Transition Zone. Without pause, apply a caudal thrust the instant you sense marked resistance to the passive tightening movement.
- **Reassess** key signs.

■ Figure 33b

- Adapt the same procedure with the patient lying supine.

■ Notes

APPENDIX

■ Historical timeline

Early history of joint traction

3000 BC - 400 BC	Physicians in early times
400 BC - 200 AD	Physicians in ancient medicine
200 AD - present	Physicians in the Middle Ages through modern times
400 AD - present	"Folks medicine" practitioners

Joint traction practiced by physical therapists

Physical Therapists were known by various names in different countries, including Gymnastic Director & Medical Gymnast (Scandinavian countries), Sykegymnast (Norway and Sweden), Physician Assistant (England and some European countries), and Masseuse.

1813 - 1934	Gymnastic Directors in Sweden. Scope of practice included both physical education and medical gymnastics.
1894 - present	Physician Assistants in England (1894), Norway (1897), and other countries (1900).
1948 - present	Physical Therapists (Sykegymnast) in Norway and Sweden. Scope of practice expanded to mirror that of the early Gymnastic Directors when many Physical Educators also studied Physical Therapy.
1960 - present	Physical Therapy Specialization in OMT and other areas, raises the level of practice for the entire profession.

Birth of modern-day manipulation professions

1813	Physical Therapy (Sweden), originally known as the Medical Gymnast specialty within the Swedish Gymnastic Director discipline.
1892	Osteopathy (USA)
1894	Physician Assistant (England), later known as Physiotherapists.
1897	Chiropractic (USA)
1908	Naprapathy (USA)

■ Early history of joint traction

Joint traction and manual manipulation have been used for musculoskeletal treatment since early times. Woodcuts, stone reliefs, and statues illustrate traction treatments in use over 5000 years ago. Today, joint traction and manual therapy are integrated into the practice of many health disciplines.

Following is a brief pictorial history of joint traction in musculoskeletal treatment. The history illustrates the refinement of joint traction techniques over the ages and its evolution into its modern forms. Today, Nordic System Orthopedic Manual Therapy incorporates joint traction into all its manual joint techniques, in various subtleties and degrees.

Traction treatment in early times (3000 to 400 BC)

One of the earliest known traction treatments for the spine was the „Falling Ladder“ maneuver, in which a patient was fastened to a ladder that could be raised and then dropped suddenly, producing a non-specific traction thrust through the spine (see *Figure A-1*).

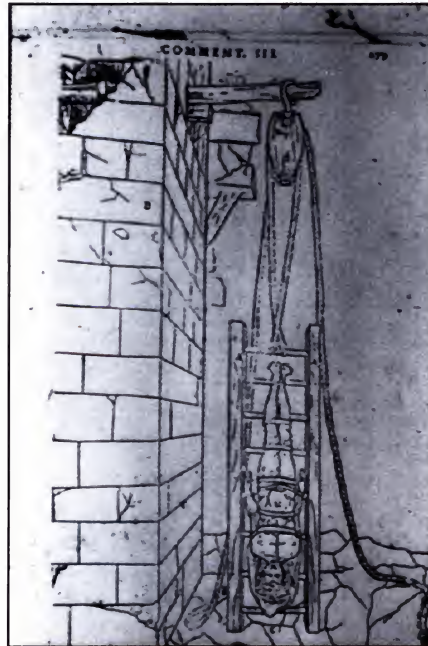


Figure A-1
Traction in early medicine (source unknown)

Traction treatment in ancient medicine (400 BC - 200 AD)

Hippocrates, the famous Greek physician and forefather of ancient medicine, utilized traction extensively. In the year 1500, manuscripts were discovered in Greece on the island of Crete, attributed to Niketas (circa 900 AD) with references to Appolonius (circa 50 AD) that refer to Hippocrates. The manuscripts included 30 drawings of various traction techniques for the spine and extremity joints attributed to Hippocrates (see *Figure A-2*).

Figure A-2'
Hippocrates (460 - 377 BC)



Hippocrates began with general techniques including the "Falling Ladder" (see *Figure A-3*).



Figure A-3
"Falling Ladder"



Figure A-4
"Stretching Kyphosis"

1 Figures A-2 to A-11 were copied with permission from Schiotz. The original works are held as a "valuable treasure" in the library Biblioteca in Firenze, Italy, as "Codex Laurenzianus LXXXIV,7".

Later in his "Peri Arthron" writings, Hippocrates criticized these non-specific treatments and introduced more specific techniques in which the physician walks (see *Figure A-7 "Tramplng Cure"*) or sits on the patient's back while traction is provided by two assistants pulling on the patient from the head and foot. Hippocrates also described combining traction techniques with vibrations (i.e., oscillations).

Another interesting traction technique attributed to Hippocrates, illustrates a patient in a kyphotic posture draped over another person's back. Hippocrates called this technique "Stretching Kyphosis" (see *Figure A-4*). It may be the first documented traction treatment in the "Actual Resting Position."

Hippocrates is also known to have used traction for extremity joint treatment (see *Figure A-5* and *Figure A-6*). This is the first documented example of manual therapy incorporating traction for the extremity joints.



Figure A-5
Hippocrates'
elbow traction procedure



Figure A-6
Hippocrates'
hip traction procedure

The era of Ancient Medicine spanned over six centuries. Near the end of that period, the Greek physician Galen (Claudius Galenus, 131 - 202 AD) studied Hippocrates techniques and incorporated them into his own approach (see *Figure A-7*).



Figure A-7
"Trampling Cure" procedure applied simultaneously with traction,
attributed to Hippocrates and documented by Galen.

His writings illustrate how he used his hands for spinal treatment while traction was simultaneously applied by assistants. This may be the first documented specific manual treatment in the spine (see *Figure A-8*).

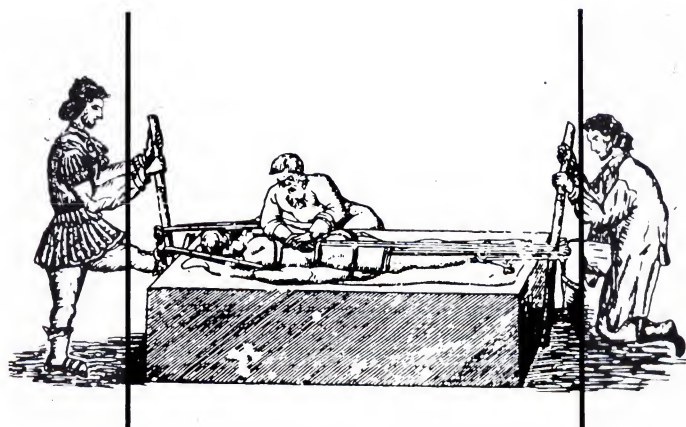


Figure A-8
Galen's "Replacing Bones" procedure utilized
manual therapy in conjunction with traction.¹

¹ In *Figure A-8*, sketches of the assistant's bodies were added by Kaltenborn to facilitate the reader's understanding of the traction procedure. Galen's original illustration of the "Replacing Bones" procedure only pictured the poles and hands of the assistants who applied traction, as in *Figure A-7*.

Traction treatment in the Middle Ages (200 AD - 1500)

In the early Middle Ages, we know that some physicians practiced traction, including Avicenna (908 - 1037) in Baghdad. Fear of infection from the Black Plague (1347 - 1350) led most physicians to abandon treatments involving physical contact with their patients. However, there were some exceptions, including the Italian physician Vidius Video (1500 - 1569) and the French physician Ambroise Paré (1510-1590 AD), a well known obstetrician who also treated "vertebral dislocations" utilizing traction combined with specific local pressures (see *Figure A-9*).



Figure A-9

Ambroise Paré applied manual therapy to the spine in conjunction with spinal traction, similar to Hippocrates methods described over 1000 years earlier.

Johan Schultes (1595 - 1645 AD), a German physician, developed a traction table for the spine to be used in conjunction with pressures to the vertebrae (see *Figure A-10*).

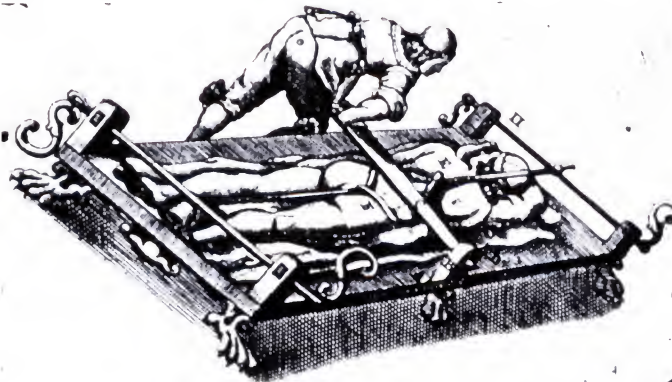


Figure A-10

Johann Schultes (Scultetus)

Traction treatment in “Folks Medicine” (400 AD - present)

The treatment of ailments by common “folk” without professional training is collectively known as Folks Medicine. By 400 A.D., traction treatment in many countries was delivered by Folks Medicine practitioners. They were known by various names, such as “Bone Setters” and “Joint Setters” (in Norwegian, “Leddsetjarar”). By 1676, Folks Medicine practice was so prevalent it could be regarded as profession (see *Figure A-11*).

Today, Folks Medicine practitioners continue to serve those who do not have access to conventional medical treatment, and those who are not helped by conventional medical care.



Figure A-11
Positional traction in Folks Medicine, 1959 (from Schiotz).
Lumbar traction in lordosis (left) and in kyphosis (right).
An early form of treatment in the Actual Resting Position.

■ Manipulation by physical therapists

The Medical Gymnastik specialty within the Gymnastik Director discipline that began in the early 19th Century, had significant influence on all the manipulative disciplines that followed. Later, a small group of male Norwegian Physical Educators studied Medical Gymnastik and Physical Therapy, and combined these disciplines into one approach. This laid the foundation for today's specialty practice in Orthopedic Manipulative Therapy, and forms a major part of today's Physical Therapy curricula.

Many physical therapists today have the mistaken belief that their profession began only 100 years ago, with the training of physician assistants in England, Sweden and Norway in the early 1900's. In reality, the physical therapy profession began with the training of Swedish Gymnastik Directors nearly 200 years ago. Earlier writers on the history of physical therapy omit mention of Swedish Gymnastik Directors.

Several contemporary manipulative disciplines began in the 1800's and early 1900's. While detailed histories of Osteopathy, Chiropractic, and Naprapathy have been well documented, little has been written about the early Swedish Medical Directors, a branch of the Swedish Gymnastik discipline, whose practice influenced all the manipulative disciplines that followed.

- 1813 Gymnastik Director (GD) founded by Per Henrik Ling with the opening of the Gymnastik Central Institute (GCI) in Stockholm, Sweden. In some countries GD's practiced as Medical Gymnasts and were later called Physical Therapists.
- 1892 Osteopathy founded by Andrew T. Still with the opening of the first School of Osteopathy in the USA.
- 1897 Chiropractic founded by David D. Palmer with the opening of the first School of Chiropractic in the USA.
- 1908 Naprapathy began in the USA, when a Chiropractic school reduced its curriculum and changed its name. That school closed in the 1930's, but courses continued in Stockholm, Sweden.
- 1948 Physical therapy specialization in manual therapy begins with "Manuell Terapi ad modum Kaltenborn" in Norway.

Swedish Gymnastik Directors (1813 - present)

In 1813, Per Henrik Ling (1776-1839) founded the Gymnastik Central Institute (GCI) in Stockholm, Sweden. The 3-year training program included two courses of study: A two-year course in Pedagogic Gymnastik (physical education and athletic training) plus a one-year course in Medical Gymnastik (therapeutic exercise). Graduates of the program were known as Physical Educators when teaching in primary and secondary schools, and as Medical Gymnasts (later known as Physical Therapists) when treating patients. Initially, GCI was only open to men. Women were not admitted to GCI until 1867. Prior to that time, Swedish women were not admitted to university studies which were a prerequisite for admittance into GCI.

By 1830, all Medical Gymnasts practiced traction in one form or another (see *Figures A-12* and *A-13*). The practice later spread to Norway, Russia, England, France, Germany, Austria, and many other countries.



Figure A-12
Swedish Gymnastic Directors performing
traction-mobilisation circa 1830. (from Ottoson)

Traction was primarily applied using Glisson's sling for the cervical spine and a traction bed for the lumbar spine. There is evidence that many physicians visited GCI in Stockholm where these techniques were taught to Gymnastik Directors.

By 1864, Swedish-trained Gymnastik Directors were officially recognized as providers of patient treatment. In 1887 they assumed the title "Sjukgymnast" (Gymnast for the Sick). This professional title remains in use today in many countries.

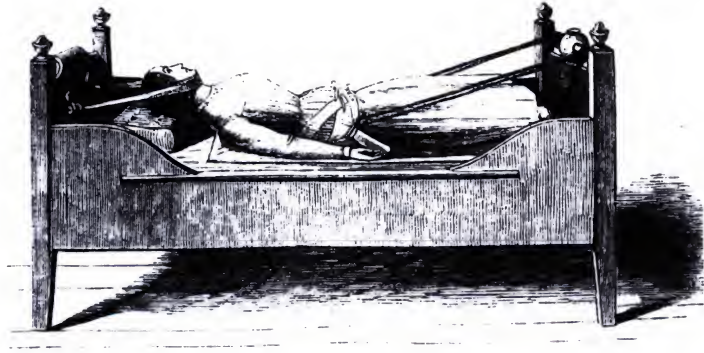


Figure A-13
Dr. Kjolstad's Traction Bed in Norway ca. 1870, practiced by Gymnastic Directors educated at GCI in Sweden (from Haugen)

In the early 1800's, Swedish physicians developed specialization in Orthopedics and found themselves in competition with the well-established male Gymnastik Director practitioners. The physicians promoted policies that weakened the Gymnastik Director profession and ultimately brought the clinical aspects of the training under their control. As a result, the Gymnastik Director profession was split into two separate disciplines:

1) **Pedagogic Gymnast.** These practitioners were trained in physical education and sports. This group was predominantly male and were not under physician control. The training began as a private two-year program and evolved over many years into a 4-year university degree program with certification in physical education and athletic training.

2) **Medical Gymnast.** Most Swedish physicians at the time called these practitioners "Masseuse" (massage practitioner). The Swedish physicians provided a one-year course of study, and further weakened the GD profession with a requirement that the course only be open to women. The profession remained dominated by women into the 1970's, with the exception of a few men who were educated on-the-job as Medical Gymnasts in other countries during and after World War II. They all used traction in their patient treatments.

In Norway in 1897, three orthopedists founded the Oslo Ortopediske Institutt (OOI), a one-year school of massage. At that time massage was considered a female profession. There were no male applicants to the program from 1912 to 1948.

Physician Assistants (1894 - present)

Few physicians provided traction treatments themselves in the late 1800's and early 1900's, however they recognized the value of the technique and taught their assistants to apply it. The education of Physician's Assistants in traction treatment began as part of a one-year massage curriculum (1894 in England, 1897 in Norway; around 1900 in other countries). Traction treatment could only be applied with a physician's prescription.

Some physicians taught traction techniques to their own Physician Assistants. The most well-known of these was James Mennell, M.D., who states in his first book, *Treatment with Movement, Manipulation and Massage* (1917), that he began teaching traction techniques to his female Physician Assistants as early as 1907.

James Mennell's successor, James Cyriax, M.D., continued his teaching and later supported the practice of traction and manipulation by physical therapists. Interestingly, James Cyriax's father, Edgar Cyriax M.D., was one of the first to theorize that the lumbar disk could give rise to back problems. He visited GCI in Stockholm and later worked with Henrik Kellgren, a GCI-educated Gymnastik Director who practiced in London, England. Edgar Cyriax wrote his doctoral thesis on Kellgren's work and married Kellgren's daughter, Anajuta Kellgren M.D., who was also trained at GCI in Stockholm.

■ Manual Therapy specialization (1948 - present)

Nordic manual therapy

In 1948, GCI in Stockholm reopened their Medical Gymnast program to male students. At the same time, the physical therapy school in Norway also reopened for male students, with the prerequisite that the men first complete studies in athletic training. In 1954, men from both programs attended the first course on Cyriax traction and manipulation techniques taught in Oslo, Norway by Freddy Kaltenborn. During the course, participants formed the first Nordic Manual Therapy Group (Spesialgruppe for Medisinsk Manipulasjon). In 1955 the group passed qualifying examinations conducted by Cyriax himself. By 1957, this group was recognized by the Norwegian National Health System and received twice the normal reimbursement for physical therapy treatments for traction and manipulation, when the treatments were prescribed by a physician.¹

¹ Norwegian and Swedish patients willing to pay privately for their care, had enjoyed direct access to Physical Therapy since the 1930's.

The Norwegian Medical Association (DNL) did not support physician referrals to physical therapists for traction and manipulation treatment at first. They withheld approval until 1959, after the manual therapy curriculum had expanded to include training by James Mennell and his chief physical therapist Janet Dennison. Ms. Dennison moved to Oslo for several months to conduct intensive training courses there, and to supervise patient treatment in Kaltenborn's clinic.

In 1958, Kaltenborn began his studies at the British School of Osteopathy (BSO). Four years later in 1962, Kaltenborn also attended the London College of Osteopathy (LCO). It was in London that Kaltenborn began his lifelong collaboration with Alan Stoddard, M.D., D.O., who taught at both osteopathic schools. In 1962, Dr. Stoddard joined other osteopaths teaching for the Norwegian Manual Therapy Group.



Figure A-14
Cyriax (left) and Stoddard (right) in Norway, 1967.

During this period, Kaltenborn joined a German medical doctor's group studying chiropractic techniques. The group's leader, Albert Cramer, M.D., authored the book "Lehrbuch der Chiropraktik". Course instructors were American-educated chiropractors (Peper, Illi, Sandberg). After a time, Kaltenborn also became an instructor for this group.

Kaltenborn integrated and refined the manual therapy practice concepts from Cyriax, osteopathy, and chiropractic into a unified approach for Nordic manual therapists. Starting in 1960, the

new practice concepts were called “Manuell Terapi ad modum Kaltenborn”. Kaltenborn became the chief trainer in manual therapy in Norway, assisted by a select group of practitioners who were trained both as Gymnastik Directors and Manual Therapists, including Olaf Evjenth.¹ The manual therapy curriculum benefitted from their instructor’s expertise in physical education, massage, proprioceptive neuromuscular facilitation (PNF), medical training therapy (MTT), automobilization, autostabilization, and athletic training in addition to manual therapy. After 1960, the Norwegian manual therapy courses spread to other Nordic countries including Denmark, Finland, Iceland and Sweden.

The Nordic manual therapy instructors soon discovered that without the support of physicians in each country, they could not introduce a comprehensive manual therapy curriculum for the physical therapists there. Help came from the Norwegian physician E.H. Schiotz MD, who authored the book, “History of Manipulation”. In his book, Dr. Schiotz supported manipulative practice by physical therapists. In 1962, Dr. Schiotz invited colleagues from Denmark, Finland and Sweden who were familiar with Cyriax’s techniques, to a course on the expanded manual therapy curriculum (see *Figure A-15*).



Figure A-15
Introductory manual medicine course, Oslo - Finse, 1962

Five instructors in white jackets: Alan Stoddard (standing at head of the spine), Albert Cramer (seated behind the spine), Arno Sollmann (standing behind Cramer), Freddy Kaltenborn (standing at far right) and Odd Hagen (standing at far left).
Three participants in dark suits: Bjorn Rosendahl, Sweden (sitting at left), Olle Nyberg, Finland (standing at left), Jens Bang, Denmark (standing in the middle rear).

1 Olaf Evjenth was trained as a Gymnastic Director in the 1950's and studied with Kaltenborn between 1960 - 1968. He joined Kaltenborn in his teaching in 1970 and worked with him to refine the Nordic System approach.

The Nordic System manual therapy courses were quite successful and attracted students from both medicine and physiotherapy, including a number of well-known orthopedic surgeons from Finland and Sweden, as well as physiatrists from Denmark. During a course in 1964, a group of Nordic physicians formed the Nordic Federation in Manual Medicine (NFMM) to organize courses for physicians and physical therapists in the Nordic countries. Kaltenborn was Nordic Education Leader for the group until 1970. Harald Brodin, professor of orthopedics and author of the book, "Manipulasjon av Ryggraden", became an important supporter of physical therapists.

Between 1964 and 1970, medical doctors and physical therapists worked together closely. The manual therapy curriculum expanded and matured into the Nordic System of Orthopedic Manual Therapy. In 1970, the NFMM disbanded, and physicians and physical therapists in each Nordic country formed their own separate manual therapy associations. This led to a new era in physical therapy training in the Nordic countries, that later spread to other nations in Europe and elsewhere.

From 1960 onward, many physicians and physical therapists visited Kaltenborn's clinic or attended his courses. Among these practitioners, were many physical therapists who made important contributions to the profession in later years, including Stanley Paris, Robin McKenzie, Geoffrey Maitland, Brian Mulligan, Mariano Rocabado, and Ola Grimsby.

International Manual Therapy

In 1967, Stanley Paris brought Freddy Kaltenborn and Geoffrey Maitland together for a meeting in London, to plan an international manual therapy association for physical therapists. In 1970, representatives from 12 countries met under the leadership of Stanley Paris and founded the World Confederation of Manual Therapists (WCMT).

In 1973, Kaltenborn arranged an international 5-week manual therapy course for physical therapists in Gran Canary, Spain. The course culminated with an examination conducted by four physicians: Harald Brodin, James Cyriax, Walter Hinsen, and Alan Stoddard. Seven of the successfully examined physical therapists formed an organization called the International Federation of Orthopedic *Manual* Therapy (IFOMT). The following year in 1974, they met in Montreal, Canada in a joint meeting with the newly formed WCMT. Stanley Paris led the meeting. The IFOMT organization formed the prior year was disbanded and in its place a new organization was formed, called the International Federation of Orthopedic *Manipulative* Therapy (IFOMT). Four physical therapists, Gregory Grieve, Freddy Kaltenborn, Geoffrey Maitland and Stanley Paris, were the founders of the new IFOMT.



Figure A-16
IFOMT founders, from left: G. Maitland, S. Paris,
F. Kaltenborn, and G. Grieve, 1974.

After much discussion, the decision was made to make a proficiency examination a requirement for membership in IFOMT. A Standards Committee was formed to develop the examinations.¹ Kaltenborn (Norway) chaired the Standards Committee, Gregory Grieve (UK) led development of the theory section of the examination, Brian Edwards (Australia) led development of the practical section of the examination, and David Lamb (Canada) coordinated the examination development process. Thus the IFOMT proficiency examination represented both Nordic OMT and the Australian Maitland approach.

1 For an overview of IFOMT's history, see "History of IFOMT" by Lamb, Kaltenborn, and Paris (Vail, CO 1992). See also, "History of IFOMT's Educational Standards and Membership" written by Kaltenborn, Lamb, and Maitland (2000).

■ The abandonment of rotatory joint techniques

Comments by Freddy Kaltenborn

By 1979, we no longer taught rotatory techniques for the extremity joints, and in 1991 we discontinued our teaching of rotatory techniques in the spine. We came to these decisions based on many years experience.

I learned my first rotatory thrust techniques for the spine and extremities in 1945, while a student in Gymnastic school (physical education) in Germany. These thrusts were applied as a continuation of a restricted movement. Cyriax advocated rotatory spinal manipulation with simultaneous strong traction forces, based on the premise that this was necessary to reduce a spinal disc protrusion.

The first time I observed anterior-posterior (translatory) joint movement and joint traction treatment, was in 1952 on a course taught by James Mennell in London. At the time, Mennell used the technique only on extremity joints. I wondered about this and began my study of joint biomechanics to gain a better understanding.

As I gained experience in patient treatment, I became aware that some rotatory techniques were more painful than others and caused problems after treatment. This rarely happened with translatory techniques, which were primarily tractions at that time. I had already begun to teach manual therapy to medical doctors and physical therapists in the Nordic countries and openly discussed my concerns about rotatory manual therapy techniques with many students and colleagues.

Olaf Evjenth, one of my students who later assisted with my teaching, joined me in my journey to develop translatory thrust techniques, primarily tractions, that were both safe and effective.

In 1992, Gwenn Jull, as chairperson of the IFOMT Standards Committee, stated in the Educational Standards document:

"Orthopaedic manipulative therapists have developed some unique procedures, which eliminate rotatory stresses and emphasize glide and distraction movements. Rotation and extension are recognised as being movements which can provide a hazard especially when applied to the cranio-vertebral region."

It is my hope that all physiotherapists, and especially member organizations of IFOMT, will recognize and respect the patient safety principles in this document.

■ The Nordic OMT name

Kaltenborn used manual therapy techniques from many disciplines as a springboard for the development of Nordic OMT. The approach included concepts and techniques from orthopedic medicine (e.g., Cyriax and Mennell), osteopathy (Still and Stoddard), and chiropractic (Cramer, Peper, Illi, Sandberg), and were built upon a foundation of athletic training and physical therapy. Physical therapists and medical doctors in the Nordic countries first studied these concepts as “Manuell Terapi ad modum Kaltenborn”, which over a period of years evolved to become the “OMT Nordic System”.

After 1970, Olaf Evjenth and Freddy Kaltenborn continued to develop the approach. They presented their theory and practice concepts at international meetings, including IFOMT meetings in 1973 and 1975 in Gran Canary, Spain, and again at IFOMT’s meeting Vail, Colorado USA in 1977, as well as on many courses throughout the world.

In some countries, the use of personal names was a prerequisite for registration of the technique and certification of practitioners. Kaltenborn and Evjenth authorized the use of their personal names under the umbrella of the “Nordic System” (e.g., “Nordic System: OMT Kaltenborn-Evjenth Concept”). Unfortunately, there has been some abuse of their names. Some manual therapy instructors today offer courses in Kaltenborn or Evjenth techniques, yet the instructors are not trained, certified, nor authorized to do so. In some cases, these instructors teach techniques that both Kaltenborn and Evjenth deem unsafe (e.g., rotatory manipulations). Kaltenborn and Evjenth have made it very clear, that they cannot assume responsibility for this.

■ Challenges for manipulation research

Comments by Freddy Kaltenborn

Evidence-based treatment decisions must be based on sound research. The joint manipulation research I have reviewed to date does not control for several critical factors. Research results are unreliable when studies do not differentiate between various techniques or the qualifications of the individuals who perform them. In addition, manipulation is defined differently by various authors. The term “manipulation” has been used to describe any type of treatment performed with the hands, from slow stretch mobilizations to manipulative thrusts.

Following are my recommendations for correcting deficiencies in current manipulation research.

Recommendations for manipulation research

1. Describe the qualifications and skills of the practitioners performing the techniques. Many current studies omit this, so we cannot be certain that the techniques were properly applied by practitioners with comparable skill.
2. Adapt the technique to the condition of the joint and its presenting pathology. Underlying joint conditions and pathologies can affect manipulation results.
3. Describe the technique in detail.
 - a. Describe the position of the joint subject to treatment. (For example, research results using a manipulation initiated from outside the Actual Resting Position, may not be applicable to Nordic OMT methods.)
 - b. Describe whether the technique is performed as a thrust or a stretching maneuver (slow stretch mobilization). (In my system thrust is used only for intraarticular disorders and stretch for extraarticular disorders.)
 - c. Specify if traction is used. If traction is used, describe the direction of traction. (My manipulation techniques apply traction with a line-of-drive at a right angle to the Treatment Plane.)
 - d. Describe whether the manipulation is translatory or rotational.
 - e. Describe the line-of-drive (treatment direction).
4. Document key signs before and immediately after treatment, in addition to longer-term follow-up.

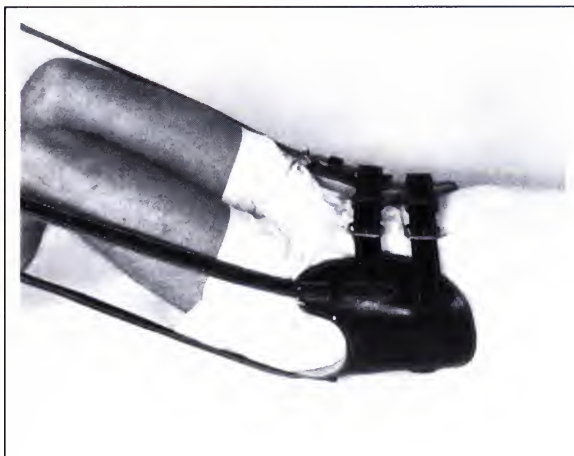
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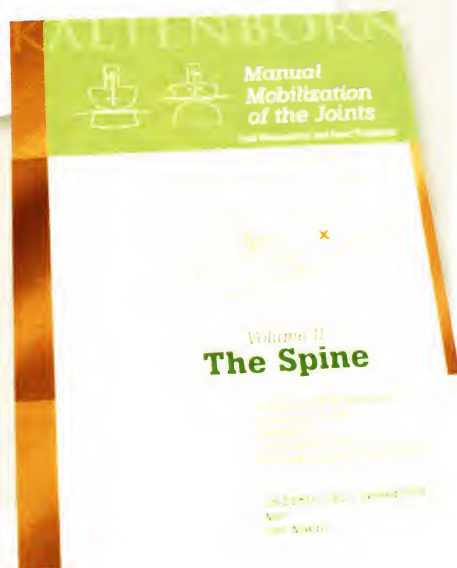
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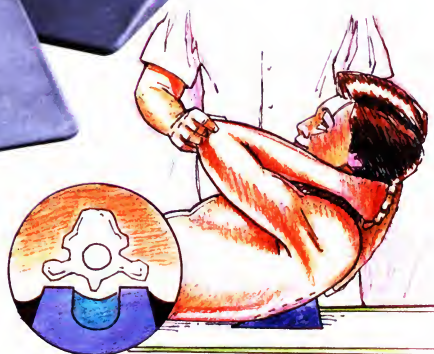
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physical educator in his native Norway, was certified in orthopedic medicine, taught as a professor of osteopathy in the USA, and was a teacher of chiropractic in Germany.

Kaltenborn wrote this manual for beginning students of manipulation. It is a companion volume to his classic handbooks on *Manual Mobilization of the Joints* that introduced thousands of clinicians world wide to the practical foundations of joint mobilization.

Students should be introduced to safe manipulation techniques early in their basic clinical education so they have an opportunity to develop the "head and hands" for these techniques over many years. In the past Kaltenborn only taught manipulation techniques to experienced practitioners in a clinical setting due to concerns over patient safety. Now, after decades of technique refinement and teaching experience, Kaltenborn has developed effective manipulation techniques that are safe to present in a classroom setting as well.

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